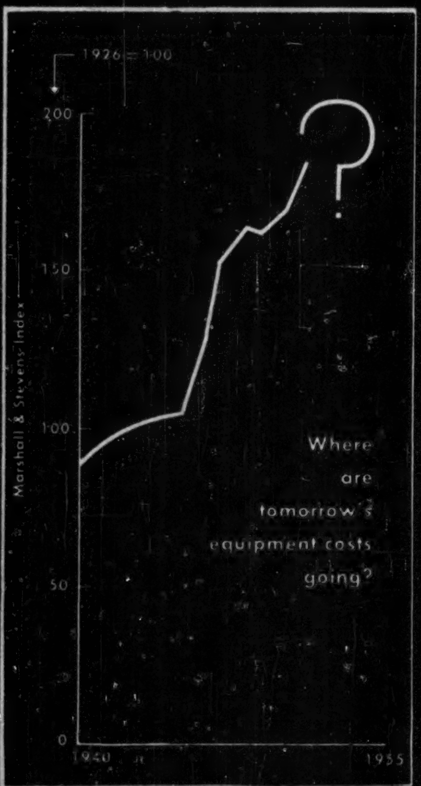
JANUARY
1953

Chemical Engineering



COST ESTIMATING:

Cost control system.

How to estimate costs in a hurry.

Project engineering costs.

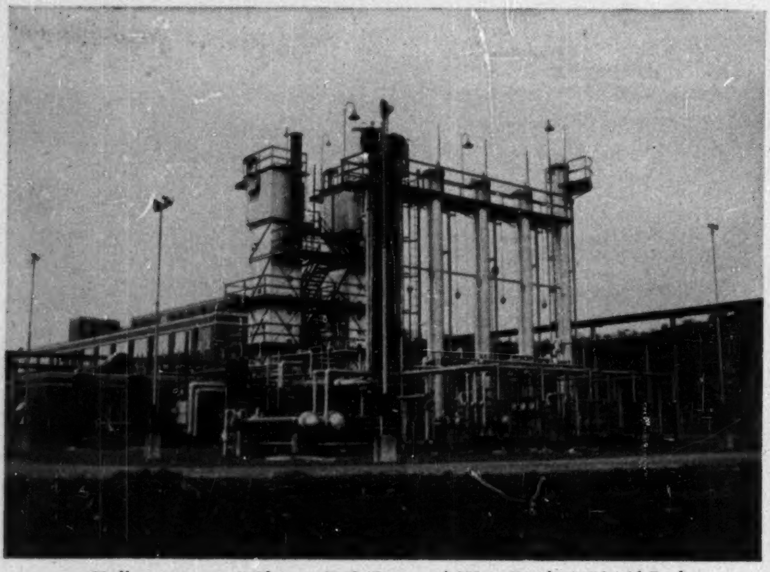
Where cost estimates go sour.

Watch your language.

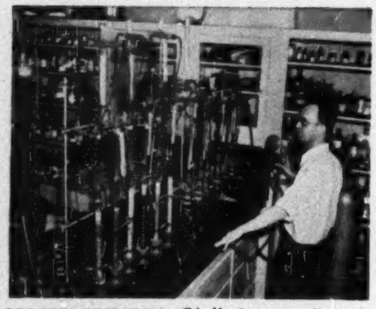
A McGRAW-HILL PUBLICATION

ONE DOLLAR

Girdler Process News



Girdler HYGIRTOL Plant at U. S. Bureau of Mines Synthetic Liquid Fuels Plant . . . supplies both pure hydrogen and various mixtures of synthesis gas.*



PROCESS RESEARCH—Girdler's research and development department is well equipped to assist with all types of process problems. A technical staff is available for consultation, and Girdler's research group can be employed on special problems at reasonable cost.

ENGINEERING—Experienced executives direct a group of engineering specialists, trained for every job requirement. In addition to basic process and equipment design, Girdler engineers have broad experience in buildings, foundations, electrical systems, boiler plants, instrumentation, etc.

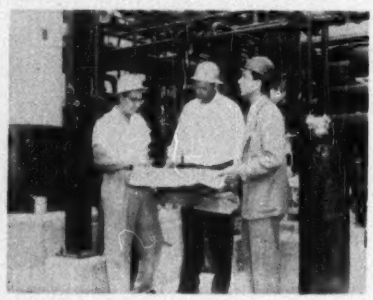
Complete engineering-construction service assures a job "well done"

FOR PROCESS PLANTS in the chemical, natural gas, and petroleum industries, Girdler assumes unit responsibility for design, process engineering, and construction. This saves you engineering manhours and time. Most important, it assures proper coordination of the whole project and successful results.

Girdler has broad experience in handling complete "process packages". . . covering design and construction of process plants involving very high operating pressures, high temperature reactions, and corrosive substances.

For the first step in your planning, obtaining factual data for evaluation, Girdler offers cost-plus contracts covering preliminary engineering . . . process recommendations, flow diagrams, general equipment specifications, plot plans, cost estimates, and operating cost data. This simplifies planning, and assures sound decisions. For a job "well done", call on Girdler in the planning stages of your processing facilities.

*HYGIRTOL is a trade mark of The Girdler Corp.



ON-THE-JOB—Girdler engineers supervise and direct all phases of construction. When the job is completed, experienced operating engineers will start up the plant, train operating personnel, run acceptance tests, and supply complete operating data.

Want More Information?

Girdler's Gas Processes Division designs and builds plants for the production, purification, or utilization of chemical process gases; purification of liquid or gaseous hydrocarbons; manufacture of organic compounds. Write for Booklet G-35. The Girdler Corporation, Gas Processes Division, Louisville 1, Kentucky. District Offices: New York, Tulsa, San Francisco. In Canada: Girdler Corporation of Canada Limited, Toronto.

the GIRDLER Corporation

LOUISVILLE 1, KENTUCKY

Gas Processes Division

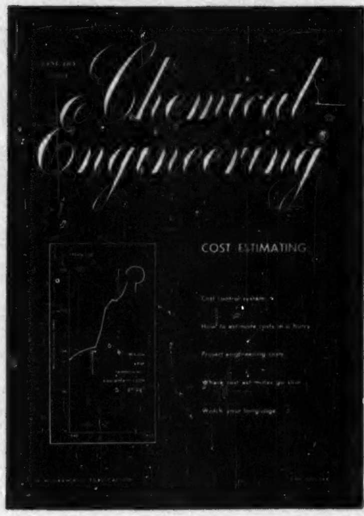
GAS PROCESSES DIVISION: *Designers, Engineers, and Constructors for the Petroleum and Chemical Industries*

VOTATOR DIVISION: *Processing Apparatus for the Food and Chemical Industries*

THERMEX DIVISION: *Industrial High Frequency Dielectric Heating Apparatus*

GUIDED TOUR

JOHN R. CALLAHAM, EDITOR



Changes That Can Help You

This issue of *Chemical Engineering* sports several changes—all aimed at making it more timely and more useful. Here's a quick rundown of what they are:

On this page we start Guided Tour. It will speed up your reading of CE and give you—at a glance—highlights of the editorial features in each issue.

We have expanded and reorganized our Contents pages (pp. 4-5). Now you can spot—and spot faster—those subjects of immediate interest.

What's Happening in Chemical Engineering (p. 110) is a new feature. It will stress technical developments and trends that are timely and significant.

Pro & Con starts on p. 152. This will be the sounding board for your opinions—and ours—on trends and events in the process industries and the chemical engineering profession. It's also your medium for commenting on our articles and reports.

The continued Guided Tour (p. 245) is akin to a second contents page. It spots the features and news among the ads in the so-called back-of-the-book.

Our brand-new department Tomorrow's Technology (p. 332) gives a rundown and digest of recent patents you should know about. It covers both equipment and processes.

These changes will make your reading of *Chemical Engineering* easier, faster and more profitable.

. . . . Today's emphasis is on costs: how to estimate and control them.

So we start off 1953 with eight timely articles on costs and how to estimate them. They have been prepared under the editorial direction of Cecil H. Chilton, our "cost" editor.

You can now brush up on the parlance of cost estimators, get the latest data on ejectors and mixers or take an inside peep at that little-discussed subject—project engineering costs.

Pierce tells you about his cost control system, Tyler gives the low-down on why many cost estimates go sour. . . .

There's more on costs in this issue—and more to come.

Put out a fire with air in 37 seconds flat—just air?

Sure. Socony-Vacuum shows how it can be done on a 2,000,000-gal. tank of fuel oil. Air agitation does the trick in this effective—and cheap—new technique *(What's Happening in Chemical Engineering)*.

Why the rare earths are now only medium-rare.

New uses getting under way will double or quadruple output by 1957. Here's a rundown on this live field and how Lindsay Chemical turns out the

Please turn page

JANUARY 1953

Chemical Engineering

GUIDED TOUR

lion's share of RE chemicals *(What's Happening in Chemical Engineering)*.

Tricky new heating system—no moving parts.

Joseph Lacey wins $100 for his novel variable-temperature heating system that uses no moving parts. It's a trick you can use in your own plant *(Plant Notebook)*.

What's so hot about CIPC?

Plenty. For isopropyl N(3-chlorophenyl) carbamate looks like the hottest herbicide to hit the field since 2,4-D. Four producers are already in the act *(Product News)*.

New compressor bridges gap

Here's a rotary compressor—literally with a "screwy" design—that bridges the gap between the usual rotary positive and centrifugal units. *(Process Equipment News)*.

Rejoin GUIDED TOUR page 245

CHEMICAL ENGINEERING

January 1953 Vol. 60—No. 1

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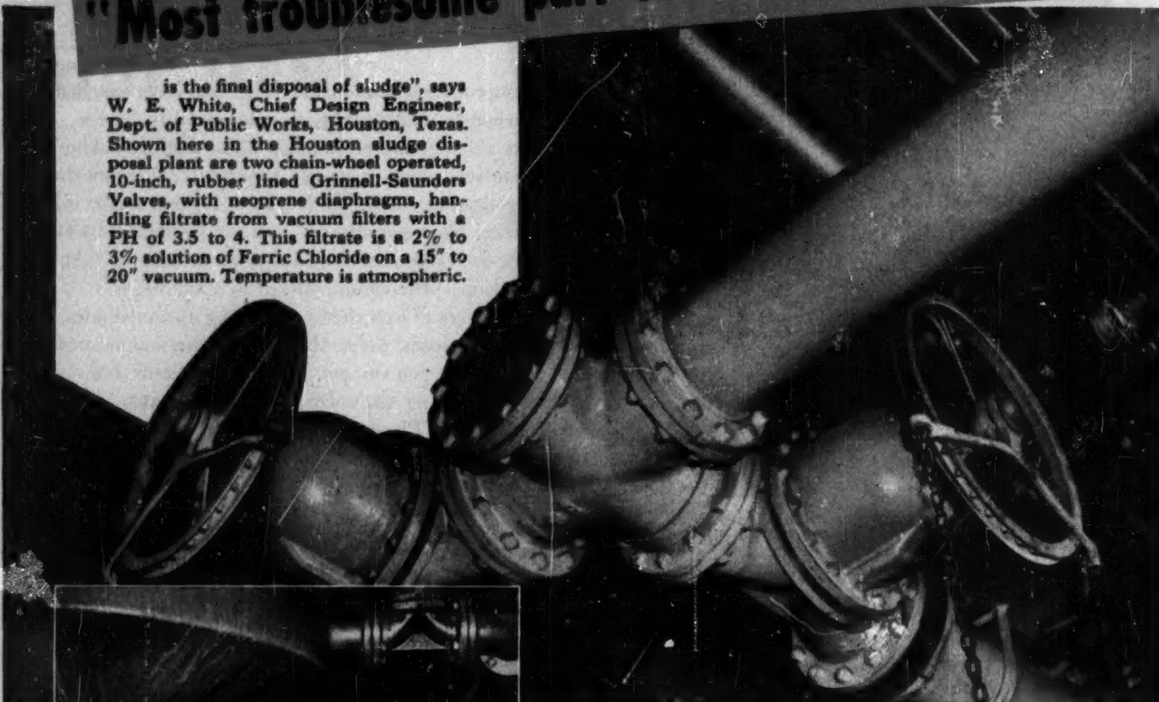
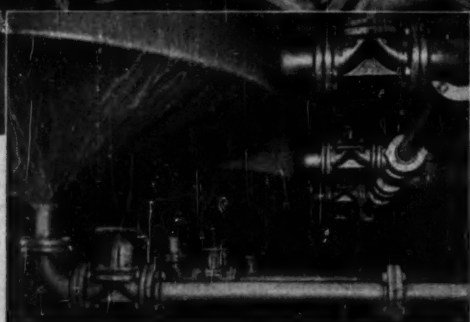
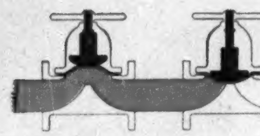
"Most troublesome part of Sewage Treatment...

is the final disposal of sludge", says W. E. White, Chief Design Engineer, Dept. of Public Works, Houston, Texas. Shown here in the Houston sludge disposal plant are two chain-wheel operated, 10-inch, rubber lined Grinnell-Saunders Valves, with neoprene diaphragms, handling filtrate from vacuum filters with a PH of 3.5 to 4. This filtrate is a 2% to 3% solution of Ferric Chloride on a 15" to 20" vacuum. Temperature is atmospheric.





◀ In same plant. Eight 3-inch rubber lined Grinnell-Saunders Diaphragm Valves, handling 8% to 10% Ferric Chloride, at atmospheric temperature



A job well-suited to

GRINNELL-SAUNDERS DIAPHRAGM VALVES

Streamlined flow. Smooth, streamlined passage, without pockets, prevents trapping of solids. Frictional resistance is at a minimum — regardless of direction of fluid flow. No disc holder in fluid stream.

Leak-tight closure against grit, scale, suspended solids. The resilient diaphragm, plus the large area of contact, gives leak-tight closure against pressure or vacuum.

Working parts absolutely isolated from fluid. Diaphragm completely seals off working parts from fluid in the line. No sticking, clogging or corroding of working parts. Valve lubricant cannot contaminate fluids.

Body, lining and diaphragm materials to meet service condition. Bodies stocked in cast iron, malleable iron, stainless steel, bronze and aluminum; other materials on special orders. Valve bodies lined with lead, glass, natural rubber or neoprene. Diaphragm materials of natural rubber or synthetics.

Minimum maintenance. No refacing or reseating is required. No packing glands to demand attention. New diaphragm can be inserted without removing valve body from the line.

GRINNELL

WHENEVER PIPING IS INVOLVED

Write for Grinnell-Saunders Diaphragm Valve Catalog

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

Another new development using

B. F. Goodrich Chemical *raw materials*

B. F. Goodrich Chemical Co. does not make this coating compound. We supply the raw materials only.

New Idea in Plastics! SPREADS LIKE PUTTY... HARDENS AGAINST CORROSION

THIS newly-developed plastic compound greatly simplifies many coating operations—has more cost-saving possibilities. Based on Geon paste resin, it is putty-like in form. It can be applied with a hand trowel on any surface, to any desired thickness.

On the plating rinse tank pictured, for example, it is simply spread on the outside surface... protects against acid spillage, plating salts and other corrosive chemicals. Formerly, applying a coating like this—usually 1/16"-1/8"—was difficult to do without costly, special dipping equipment.

The coating is fused by oven baking or infra-red lamps. Containing no volatile materials, it is safe to use; there is no viscosity change during storage. And because it is based on Geon, it has all of Geon's advantages—resistance to most acids and chemicals... oils... greases... abrasion and aging.

Geon materials—resins, latices and compounded plastics—are used in scores of ways. They help make durable flooring, long-wearing upholstery, rigid tubing and paneling, fire-resistant safety clothing and more saleable products. Find out how they may help *you* improve or develop products. For technical bulletins, write Dept. GE-1, B. F. Goodrich Chemical Co., Rose Bldg., Cleveland 15, O. In Canada: Kitchener, Ontario. Cable address: Goodchemco.

Geon Polyvinyl Materials

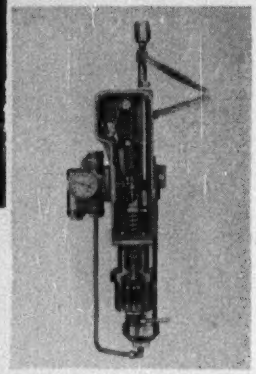
GEON RESINS • GOOD-RITE PLASTICIZERS... the ideal team to make products easier, better and more saleable.

GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers • HARMON organic colors

For an Important INCREASE IN PROCESSING LINE PERFORMANCE

BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES

Send for them



Bulletin 963 features the CASH STANDARD Type 100 Series of Super-Sensitive Controllers — various types for automatically operating valves, dampers, rheostats, stokers, pulverizers, fans, and other apparatus. 16 pages filled with descriptions and applications.

The "1000" Valve, upon installation, goes to work smoothly and effectively without that frequent attention ordinarily experienced.

You don't get those valve "kick-ups" that cause production delays and figure mighty costly over a given period.

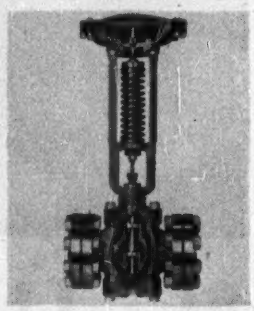
"Straight line flow" which is incorporated in the "1000" valve design is the reason you avoid valve troubles.

To find out how this "STREAMLINED" design works to your advantage in elimination of failures, speedier production, no spoilage, and in lower costs, send for Bulletin 962.

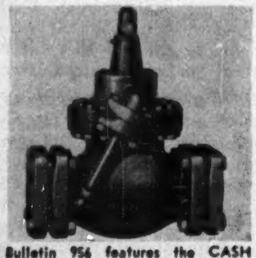
CASH STANDARD *Streamlined* **PRESSURE REDUCING VALVE** TYPE 1000

There are no complicated inside works in the "1000" valve. As a matter of fact, there is only the one vital moving part — the seat piston. There are no restricted passages—no small ports — no aggregation of close fits.

Maximum Capacity When Needed Most • Accurate Pressure Control Under Toughest Working Conditions Trouble-Free Service • Smooth Operation • Tight Closure • Accurate Regulation • Speedier Production Results • Elimination of Failures • Constant Delivery Pressure • Cost Saving Operation • No Spoilage • Practically Zero in Maintenance Costs



Bulletin 968 features the CASH STANDARD Type 34 Pressure Reducing Valve — direct operated — direct acting for handling steam, hot water, cold water, air, oil, brine—and most liquids and gases except some injurious chemicals. Illustrates and describes the different styles available and tells about their applications. Three pages of capacity charts.



Bulletin 956 features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.

CASH STANDARD CONTROLS.. VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

When one big chemical company has placed a dozen orders for Bird Centrifugal Filters over the past 10 years, now has 33 Birds operating on 8 different materials — ***THAT'S A GOOD SIGN.***

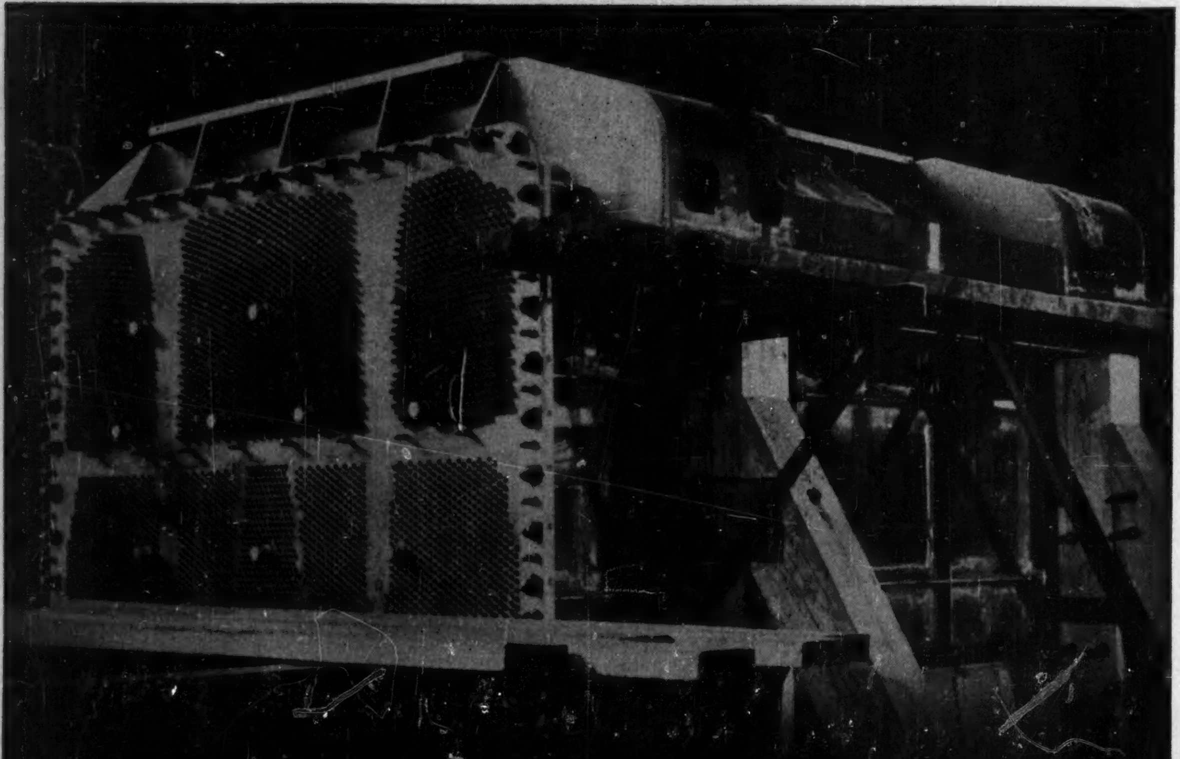
When another placed his first order for one of the largest size (ton-a-minute) BIRDS four years ago, now has thirty more running or on order —
THAT'S A GOOD SIGN.

When one pulp producer not long ago installed a Bird Filter for dewatering lime mud and fifteen more BIRDS have now gone into pulp mills on this same application —
THAT'S A GOOD SIGN.

We could give many other examples but the above should indicate that Bird continuous centrifugal filtration is entitled to consideration the next time you're faced with the problem of selecting new, additional or replacement Filters.

The Bird Research and Development Center is fully equipped to provide comprehensive, accurate and unbiased test data in advance of any commitment on your part.

BIRD MACHINE COMPANY
SOUTH WALPOLE • MASSACHUSETTS



It will pay you as it has paid others to

Specify Revere

CONDENSER TUBES AND PLATES

It is significant that year after year important users of condenser tubes and plates specify Revere, not only for new equipment, but when re-tubing. You might consider this fact if you are not as yet a Revere customer.

Remember that Revere can give you more than tubes and plates. If you have questions regarding the most suitable alloy to meet operating conditions, the Revere Technical Advisory Service will be glad to collaborate with you on this subject. If your present tubes do not seem to be giving the service expected of them, the same Service will look into the matter. Such factors as vibration, air entrainment, water velocity, impingement attack, changed water conditions, tube composition, and others will be studied and recommendations made. In a great many cases we have pointed the way to greater tube economy, increased service life.

As part of our service to condenser operators we have prepared a 28-page booklet entitled "Life Extension for Condenser Tubes." Ask for it on your company letterhead and it will be sent free.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

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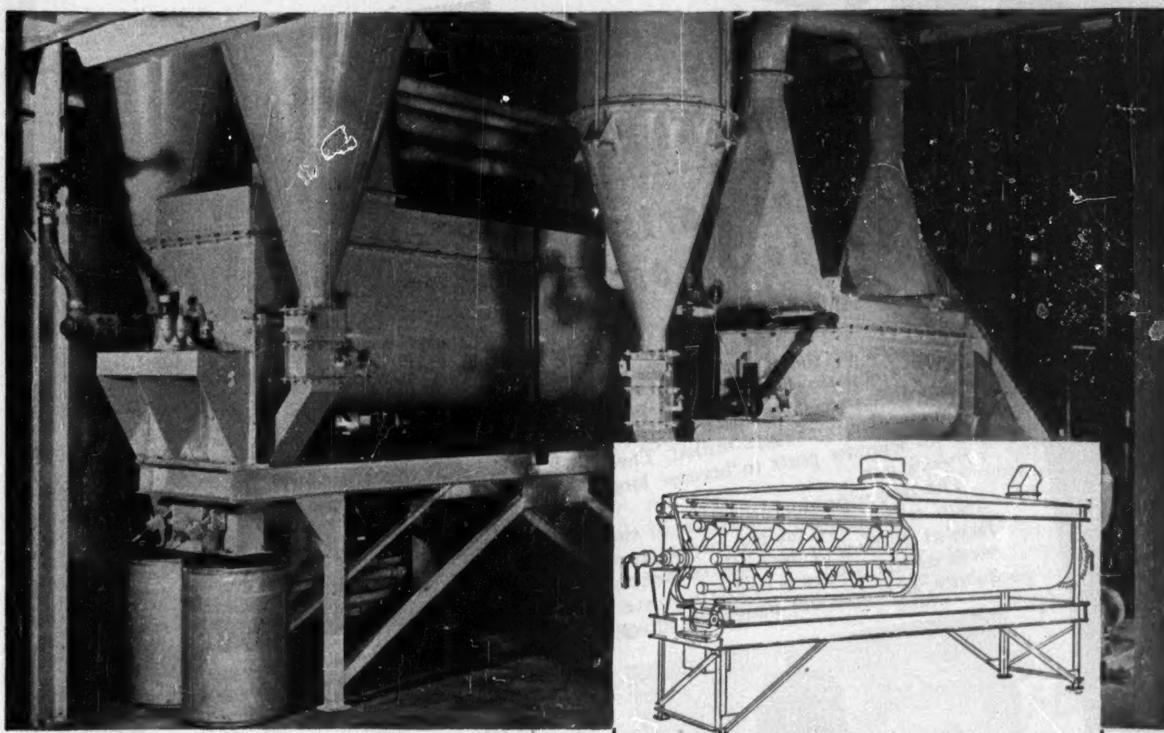
Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities, Distributors Everywhere

SEE REVERE'S "MEET THE PRESS" ON NBC TELEVISION EVERY SUNDAY

NOW--get economical drying · cooling · solvent recovery with LINK-BELT's new, low-cost

MONOTUBE DRYER



Here is a two-unit Monotube installation that paid for itself in six months. The pharmaceutical manufacturer recovers solvents which were formerly lost.

Paddle conveyor on hollow shaft turns in U-shaped trough. Steam, hot liquid or coolant circulates through shaft and outrigger tubes, producing efficient transfer of heat as material is churned and conveyed through trough.

PROCESSORS of chemicals, pharmaceuticals, food, vegetable oils and other materials report attractive savings using the Link-Belt Monotube Dryer. This compact unit utilizes only one moving part . . . provides constant agitation of material to assure uniform, efficient drying without overheating.

In addition, the Monotube Dryer practically eliminates dusting—there are no air currents through the material bed. More—it's extremely flexible . . . operates equally well at high or low temperatures.

If your production requires drying, cooling or solvent recovery, send a sample of your material—a pound or a ton—to Link-Belt. We'll analyze it . . . work out procedures in our laboratory that can be duplicated in your plant. Link-Belt can specify the correct type and size of dryer for your exact need—either the new Monotube or one of the other types of Link-Belt dryers. Call the Link-Belt office nearest you . . . or write for new Link-Belt Book 2413.

LINK-BELT COMPANY: Plants—Chicago, Indianapolis, Philadelphia, Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices in Principal Cities.

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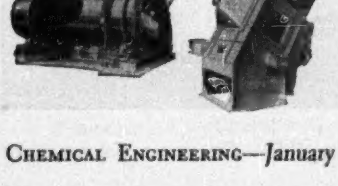


LINK-BELT

DRYERS · COOLERS
ROASTERS


TERRY
THIS TURBINE WHEEL
has no parts to loosen or work out
The rotor of the Terry Solid-wheel Turbine is a single forging of special composition steel, in which a series of semi-circular buckets is milled. There are no separate parts to become loose or work out.
The power-producing action of the steam takes place on the curved surfaces at the back of the buckets. Hence, wear of the blades is of little consequence, as it does not materially affect horsepower or efficiency. There is practically no end thrust since the steam enters and leaves the wheel in a direction at right angles to shaft.
This is only a small part of the story of the many advantages of the Terry Solid-wheel Turbine. Write for complete details.
Action of steam in a Terry Solid-wheel Turbine. The steam issues from an expanding nozzle at high velocity and enters the side of the wheel bucket where its direction is reversed 180°. As this single reversal uses but a portion of the available energy, the steam is caught in a stationary reversing chamber and returned again to the wheel. This process is repeated several times until practically all of the useful energy has been utilized.
THE TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.
TT-1189
Memo
Send for a copy of bulletin S-116 which describes the many advantages of the Terry Solid-wheel Turbine.

Only B. F. Goodrich makes the grommet belts that cut costs 20 to 50%!

Save 3 ways! Investigate today! Write or mail coupon

You save belt costs because belts last longer, save production costs because machines keep running with fewer interruptions, save maintenance costs because they need less attention.

Patented grommet belts by B. F. Goodrich represent the only basic change since invention of the V belt. Belts last 20 to 50 per cent longer, depending on service. (The more severe the service, the greater the increase over ordinary belts.) Grommet belts have more rubber; they're more flexible, give better grip, less slip.

What is a grommet?

A grommet is like a giant cable except that it's *endless*—a cord loop built up by winding heavy cord on itself. There is no overlapping cord *section* as in all ordinary belts. Most belt failures occur in these sections where cords overlap!

All cords put to work

Each of the two grommets and every part of a grommet carry their share of the load. In ordinary belts under high tension the center cords "dish" because tension is greater near the driving faces. Dished cords are doing less work, not pulling their share. Grommet belts have no center cords, there is no dishing—therefore much more strength in proportion to cord volume—and less stretch. Grommet belts stretch, on an average, only about one-third as much as ordinary belts.

Better grip, less slip

Grommet belts have more rubber in relation to belt size. Without any stiff overlap, they're more flexible, grip pulleys better. Size for size, grommet belts give ⅓ more gripping power, pull heavier loads with a higher safety factor. Because there is less slip, there is also less surface wear.

Send for proof

Send the coupon for a set of reports telling users' experiences and showing actual installations where grommet belts outlasted all others. Some typical cases:

"... within a few days ordinary belts had stretched ... After six months of 24-hour-a-day service BFG grommet belts haven't stretched at all ..."

"Ordinary belts lasted only 5 or 6 weeks ... B. F. Goodrich grommet belts are in their sixth month of service ..."

"Previous belts suffered from shock loads, wore out fast ... BFG grommet belts have been in service 2 years with no shut-downs..."

There are hundreds of cases like these.

They cost no more

BFG grommet belts cost not one cent more than others. The savings they make for you are clear profit. They are made in C, D and E sections. They are patented by B. F. Goodrich. No other V belt is a grommet belt (U. S. Patent No. 2,233,294).

Write, send the coupon or see your B. F. Goodrich distributor. (He will show you his "X-ray" belt that shows the grommet construction clearly.)

Grommet V-Belts BY

B.F. Goodrich

FIRST IN RUBBER

The B. F. Goodrich Company
Dept. CE-1
Akron, Ohio

☐ Send set of reports telling users' experiences and showing actual installations proving that B. F. Goodrich grommet belts outlast all others.

☐ Have distributor show me the "X-ray" belt that shows how B. F. Goodrich grommet belts are made.

Name________________

Firm Name________________

____

Street Address________________

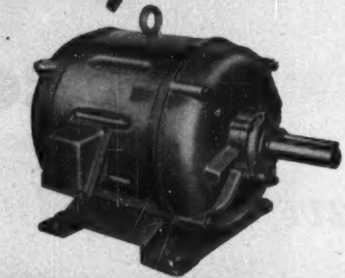
City________________

State________________

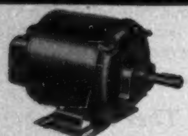
Wagner
ELECTRIC MOTORS
...the choice of leaders in industry

Wagner Quality Motors *for your product or your plant*

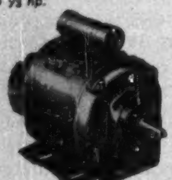
When you select a motor from Wagner's complete line, you get a motor that is completely dependable in its specific application. You can choose from a wide variety of types and sizes. Here are a few of the motors in the Wagner line. At right is TYPE RP—open type polyphase squirrel-cage motor. It is drip-proof and suitable for all general purpose applications. 1/6 to 400 hp.



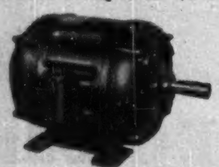
SINGLE-PHASE



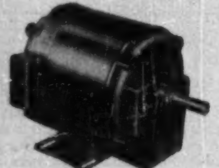
TYPE RB—Split-phase Induction. For easy starting applications with high starting current. 1/20 to ⅓ hp.



TYPE RK—Capacitor-Start Induction. For general purpose applications requiring high starting torque—normal starting current. 1/6 to 3 hp.

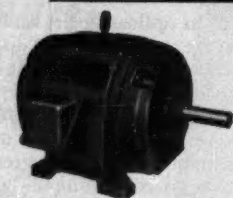


TYPE RG—Repulsion-Induction. For high starting torque applications involving a very long starting period. 1 to 5 hp.

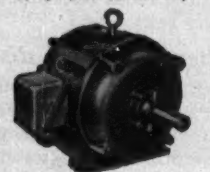


TYPE RA—Repulsion-Start Induction. For general purpose applications with high starting torque—low starting current. ⅓ to 15 hp.

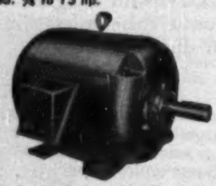
POLYPHASE MOTORS



TYPE XP—Splashproof. Protected against splashing or dripping liquids. ¾ to 200 hp.

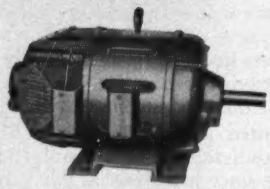


TYPE TP—Totally-enclosed, non-ventilated. Fully protected. ⅙ to 15 hp.

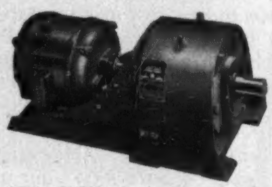


TYPE CP—Totally-Enclosed Fan-Cooled. Protected against dirt, chips, abrasives or fumes. Steel frame. 1 to 250 hp. Also in explosion proof type HP.

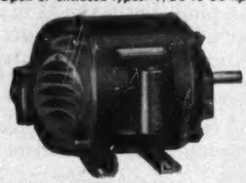
TYPE EP—Corrosion-resistant Totally-Enclosed Fan-Cooled. Cast iron frame. 2 to 250 hp. Also available in explosion proof type JP.



TYPE RS-1—Wound Rotor. Constant or adjustable varying speed. 1 to 250 hp. TYPE RS-2 for intermittent service. 2 to 200 hp.



GEAR MOTORS—Single-phase or Polyphase. Open or enclosed types. 1/20 to 50 hp.



DIRECT CURRENT MOTORS—Companion line to Wagner A.C. Motors. 1/6 to 3 hp.

• • •

In addition to a complete line of motors, Wagner also furnishes Increment Type Motor and Starter Combinations, Jet Pump Motors and a complete line of Transformers: Dry-type, Distribution and Power. Wagner engineers welcome an opportunity to serve you. Consult the nearest of 32 Branch offices, or write direct.

Wagner Electric Corporation
EST. 1891

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6407 Plymouth Ave., St. Louis 14, Mo., U.S.A.

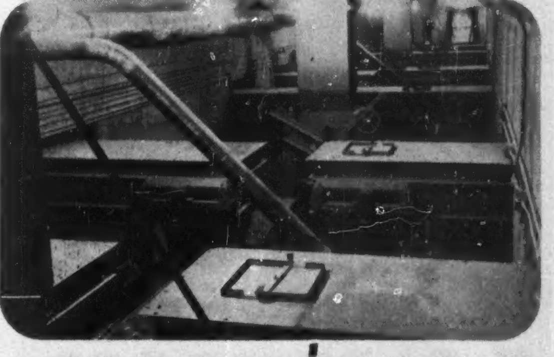
ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

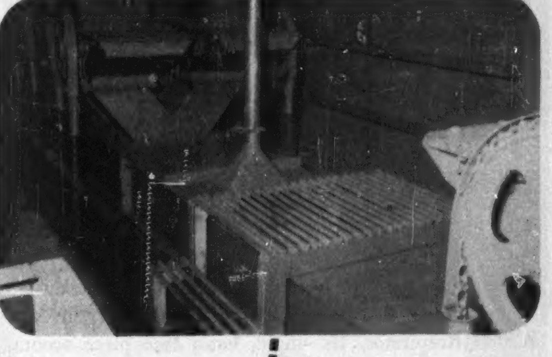
3 Fairfield installations

speed grain handling at Central Soya's Decatur Plant

Fairfield Installation Number One features 2 Fairfield Drag Conveyors which take soft feed from any one of 13 storage bins and carry it to vertical conveyors for eventual loading of trucks, railroad cars, pellet mills or bagging scales.



Fairfield Installation Number Two incorporates 12 Fairfield Drag Conveyors that remove meal directly from large storage silos and feed this meal onto a large belt conveyor for further distribution to a bagging scale or railroad car. The Fairfield conveyors can be operated singly or in multiples, depending on requirements.



Fairfield Installation Number Three utilizes 2 Fairfield Drag Conveyors which carry feed pellets from 16 bins to the bagging scales or bulk feed trucks. Versatile design enables these Fairfield conveyors to be charged from either end or carry material in either direction, depending on loading destination.

These installations at Central Soya of Decatur, Indiana are just a few examples of Fairfield's complete engineering, manufacturing and erection service to solve material handling problems. Regardless of the type of material you process, Fairfield's complete one-source responsibility can profitably solve your material handling problems. Send for a free copy of Bulletin 152 outlining Fairfield services today.

FAIRFIELD

THE FAIRFIELD ENGINEERING COMPANY, ***349 Chicago Ave., Marion, Ohio***

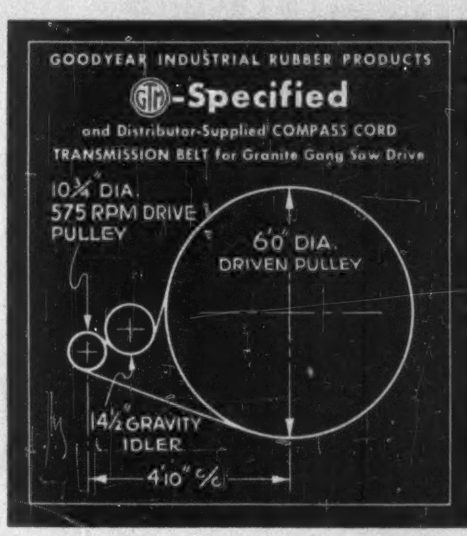
DOUBLED BELT LIFE

by consulting Goodyear Distributor

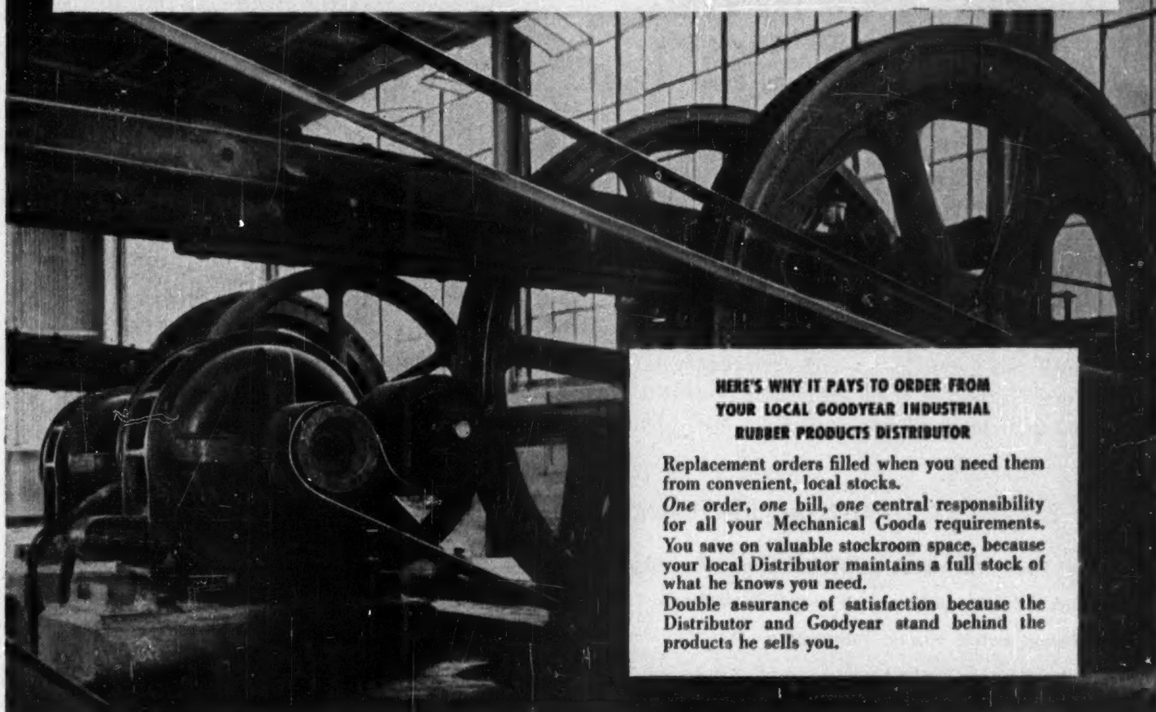
OPERATOR of this granite gang saw called a Goodyear Distributor for help with his flat belt drive. The Distributor came, bringing along the G.T.M.—Goodyear Technical Man—to analyze the drive and make belt recommendations.

The G.T.M. studied the drive, made his engineering recommendations, specified the belts to handle the problem. Result: the COMPASS Flat Belts he recommended delivered two years' service—*double the best previous record*. The Distributor took over—now stocks the exact replacement belts the operator needs—can deliver them right out of stock at any time.

You can get service like this, too—specification of the *right* product and on-call delivery—simply by calling your nearest Goodyear Industrial Rubber Products Distributor. Look for him in the yellow pages of your Telephone Directory—handling Hose, Flat Belts, V-Belts, Packing, Tank Lining, Rubber-Covered Rolls—or write for an introduction to Goodyear, Mechanical Goods Division, Akron 16, Ohio.



Compass—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio



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You save on valuable stockroom space, because your local Distributor maintains a full stock of what he knows you need.
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GOODYEAR

THE GREATEST NAME IN RUBBER

We think you'll like "THE GREATEST STORY EVER TOLD"—every Sunday—ABC Radio Network THE GOODYEAR TELEVISION PLAYHOUSE—every other Sunday—NBC TV Network

3. Regulated power for each six assembly rectifier bank is obtained from an auto-regulating transformer (left) supplemented by a 32-step regulator. Two phase shifters (right) are also used for each bank of rectifiers.

4. Rectifier transformers are alternately connected wye and delta. This arrangement plus phase shifters results in each six-transformer bank providing a 36-phase system that minimizes communication circuit interference.

5. Rectifier room, containing twelve 6000-amp, 600-volt, 12-tube, *Excitron*-type rectifiers. Each is a factory-assembled unit, complete with built-on evacuating apparatus, water-to-water heat exchanger, and water circulating, control and protective equipment. (See list at left for six **exclusive features** of Allis-Chalmers *Excitron* rectifiers.) In picture above at left are the anode breakers; at right, the cathode breakers with disconnect switches; and in the center, the excitation compartments containing excitation, phase control, vacuum measuring, and protective equipment.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

Our Engineers Introduced Mercury Arc Rectifiers to U. S. Industry

Commercially Available for the First Time

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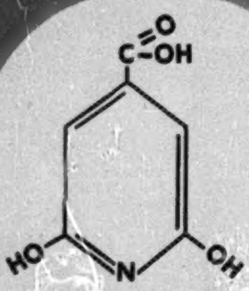
CITRAZINIC ACID

WHERE DOES THIS VERSATILE PYRIDINE COMPOUND FIT IN YOUR PICTURE?



● CITRAZINIC ACID—"CZA"—is an organic acid having a high degree of functionality which makes possible reactions not readily achieved with other available pyridine bases.

"CZA" opens new vistas for research in pharmaceuticals, agricultural chemicals, dyestuffs, graphic arts, metal treatments, coating compositions and many other chemical processing industries.

The personnel of Pfizer's Technical Service Department is at your disposal to assist in your work with "CZA."

*Trade Mark

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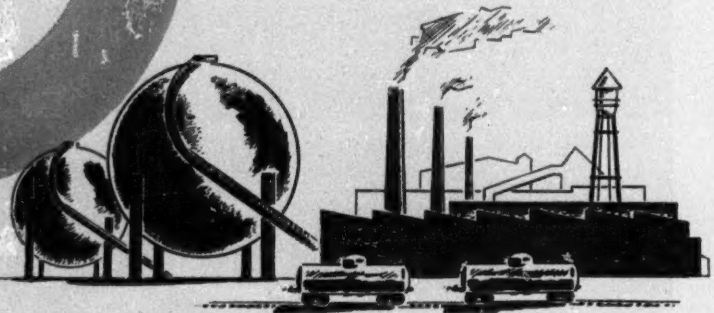

WRITE FOR TECHNICAL DATA SHEETS AND SAMPLES

CHAS. PFIZER & CO., INC., Dept. C.A.-2
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GENTLEMEN PLEASE SEND:

Technical data on Citrazinic Acid—"CZA" ☐

Sample ☐

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Manufacturing Chemists for Over 100 Years Pfizer

Performance records prove.....

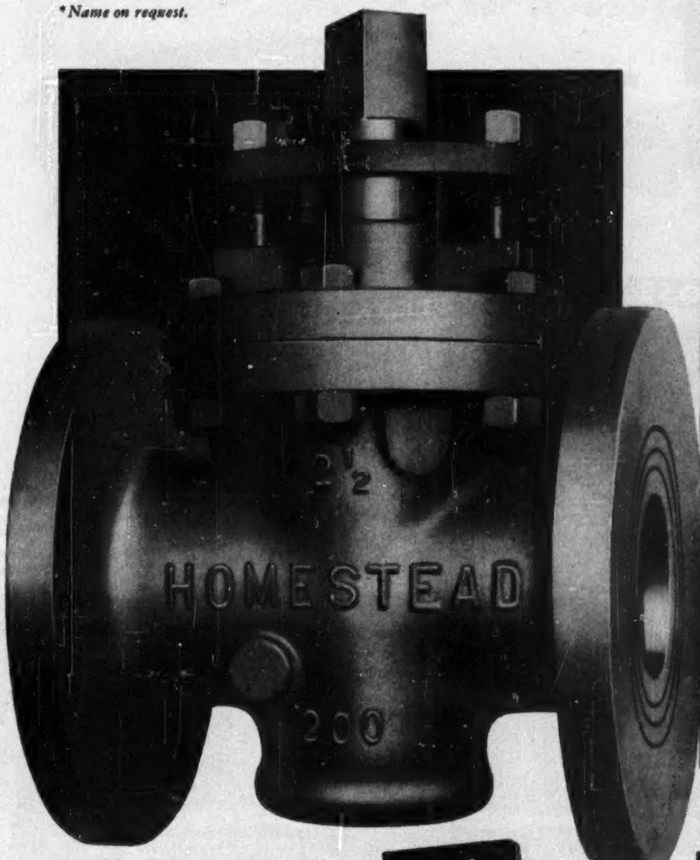
A pottery* in Ohio tried practically every type of valve on its "slip" lines, but the highly abrasive material, at 125 pounds pressure, ruined the average valve in a few months—in some cases, in a few weeks. Our engineers recommended HOMESTEAD Cam-Seald VALVES with special, hard-faced plugs and bodies. The pottery installed them on all "slip" lines in the plant.

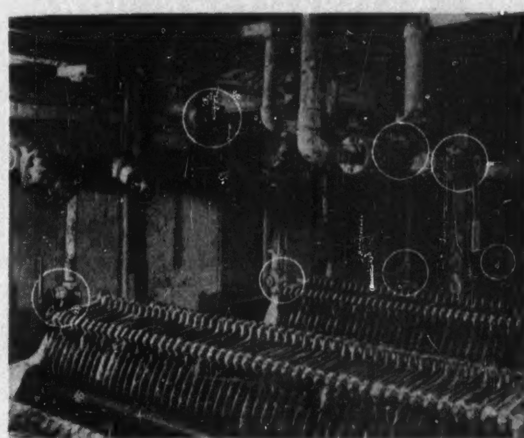
Performance records kept during the past several years show that the HOMESTEADS are lasting more than three times longer than any other valve previously used. Savings in replacement and maintenance costs repay many times over the first cost of the HOMESTEADS.

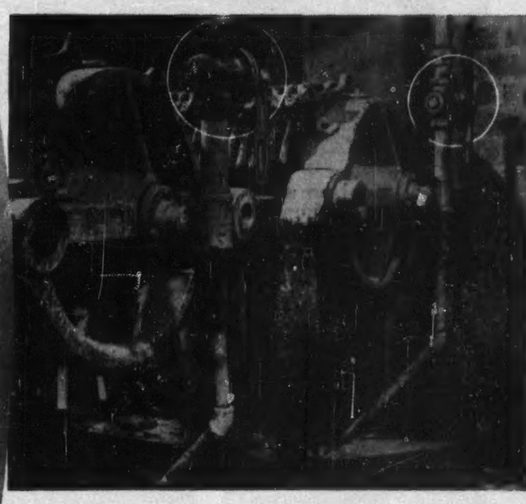
For more than 60 years HOMESTEAD VALVES have been licking equally tough jobs on scores of services in many different types of industries. Chances are there's a valve problem they can solve for you. Why not ask our engineers about it? No obligation.

**Name on request.*

HOMESTEAD VALVES are a "Better Buy"







Write today for VALVE REFERENCE BOOK No. 39. No obligation. Consult Yellow Pages of Phone Book for local Representative.

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VALVE MANUFACTURING CO.
"Serving Since 1892"
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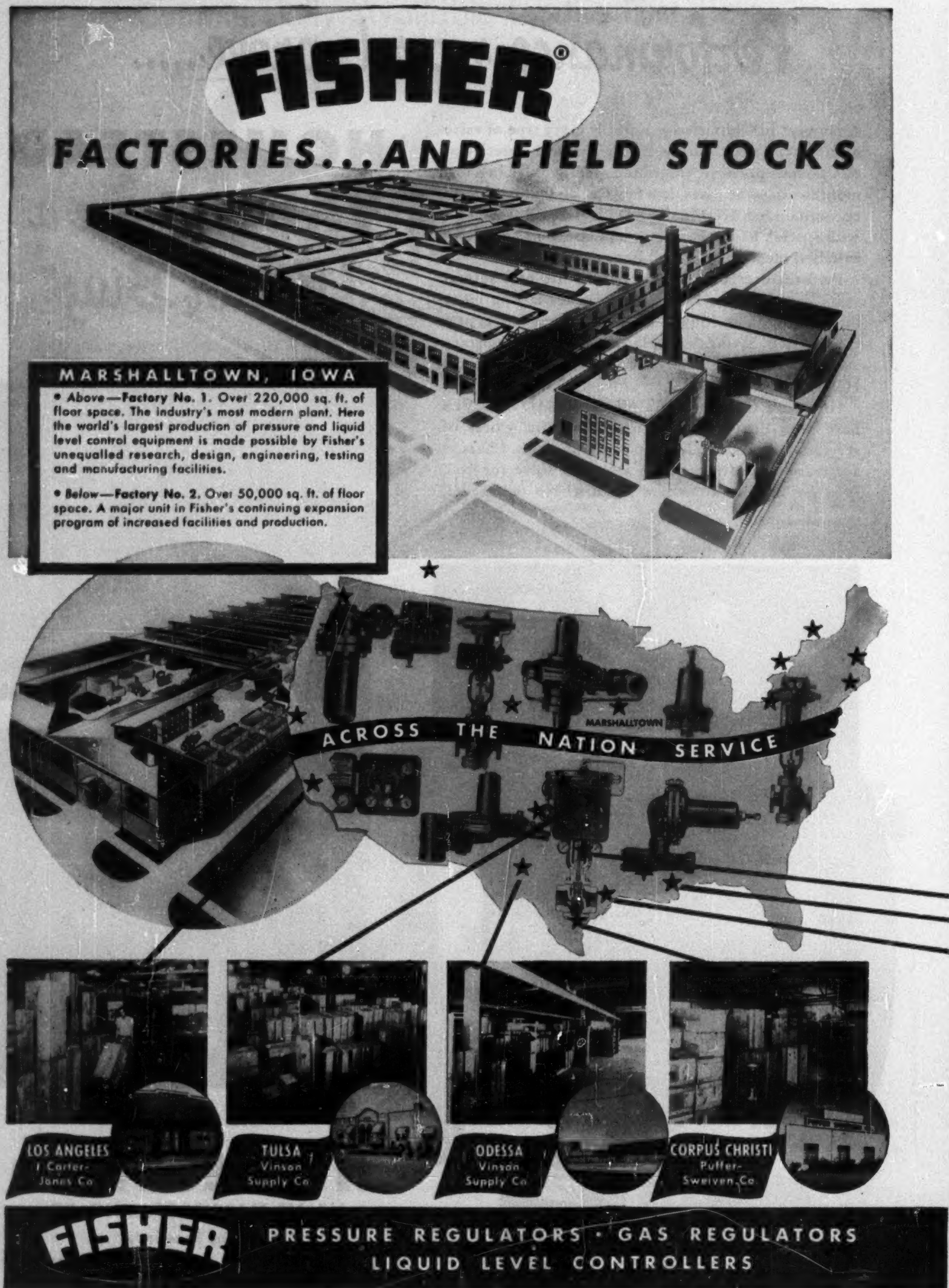
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When you want it!

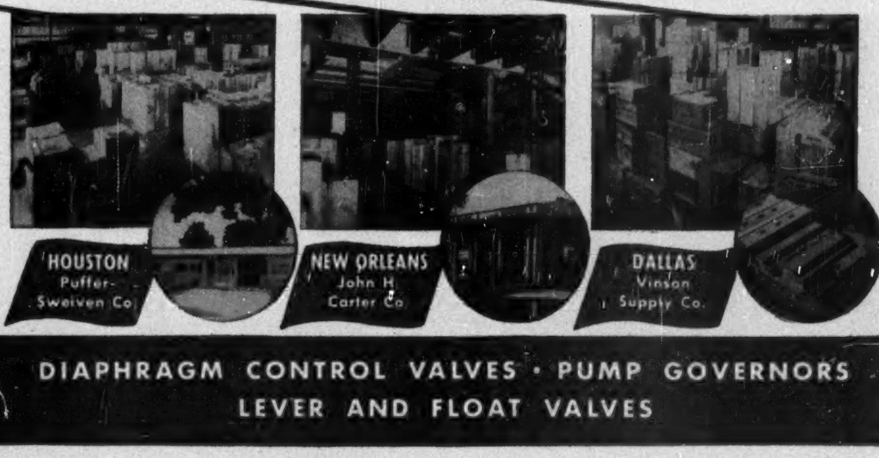
You are *always* close to a source of supply of Fisher *control valves, gas regulators, liquid level controllers* and *pressure regulators.*

Whether your problem is one of existing equipment—or an entirely new control application—the Fisher country-wide network of *19 strategically located field stocks* and *51 representatives*—with over *200 Fisher Service Engineers*—offers you *immediate* and *convenient* service on all your control requirements.

A few typical Fisher Warehouse Stocks of new equipment and replacement parts are shown below.

FISHER GOVERNOR COMPANY • MARSHALLTOWN, IOWA

WORLD LEADER IN RESEARCH FOR BETTER PRESSURE AND LIQUID LEVEL CONTROL



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LEVER AND FLOAT VALVES

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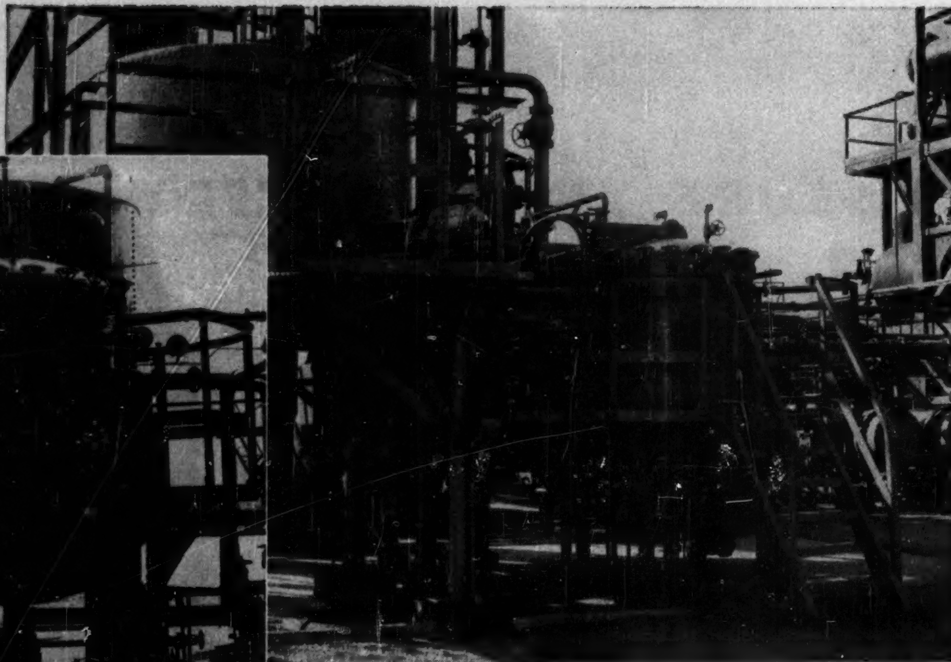
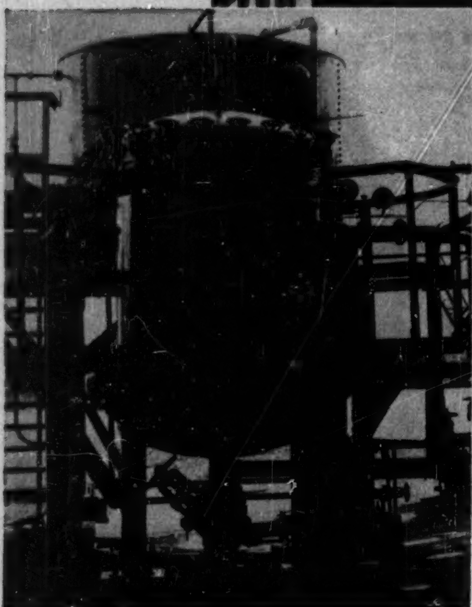
* *Indicates Field Stocks.*





This Niagara Filter, at Shell Oil's Houston refinery, removes troublesome iron sulfide from solutizer solution. The results, in annual savings and uniform gasoline quality, are described below.

NIAGARA FILTER keeps Solutizer Solution "on-stream"

Shell Oil Company uses a Niagara Filter in its solutizer mercaptan extraction process and thereby effects "a significant annual saving."

Caustic solutizer solution is introduced into the extraction system, where it comes into contact counter-currently with the mercaptan-containing hydrocarbon fraction. The treated fraction and fat solutizer solution are withdrawn from opposite ends of the system.

A Niagara Filter was installed to remove the small amount of iron sulfide particles (averaging 20 microns) which gradually accumulate in fat solutizer solution. These insoluble materials in the system act as nuclei for troublesome emulsions and impair the effectiveness of the plant. The iron sulfide is contained in gasoline streams entering the solutizer plant.

The Niagara Filter has 16 stainless steel leaves with a total filter area of 322 sq. ft. It is delivering solutizer solution free from iron sulfides, at a flow rate of 2700 GPH—and is doing this continually for a period of 64 hours before it is necessary to clean filter.

Continuous filtration helps to keep operation of the solutizer plant at high efficiency. Gasoline production remains uniformly high in octane number and tetraethyl lead susceptibility.

Niagara all-metal filters always save through elimination of filter cloths, simplicity of operation, increased filtration rates and long life of the stainless steel solderless filter leaves. Niagara filtration engineers are experienced in all types of filtration processes. They may be able to help you with your problems, and will be glad to test samples and tell you about pilot filter rental and other services. A letter from you outlining the problem will bring a prompt reply without obligation. Use the coupon below to order Bulletin G-447 for your files.

Niagara Filter
CORPORATION

IN EUROPE—NIAGARA FILTERS EUROPE, 36 Leidsegracht, Amsterdam-C, Holland

NIAGARA FILTER CORP., [illegible] Main St., Buffalo 14, N.Y.

Please send me details of Niagara Pilot Plant Filter rental □; Bulletin G-447 □.

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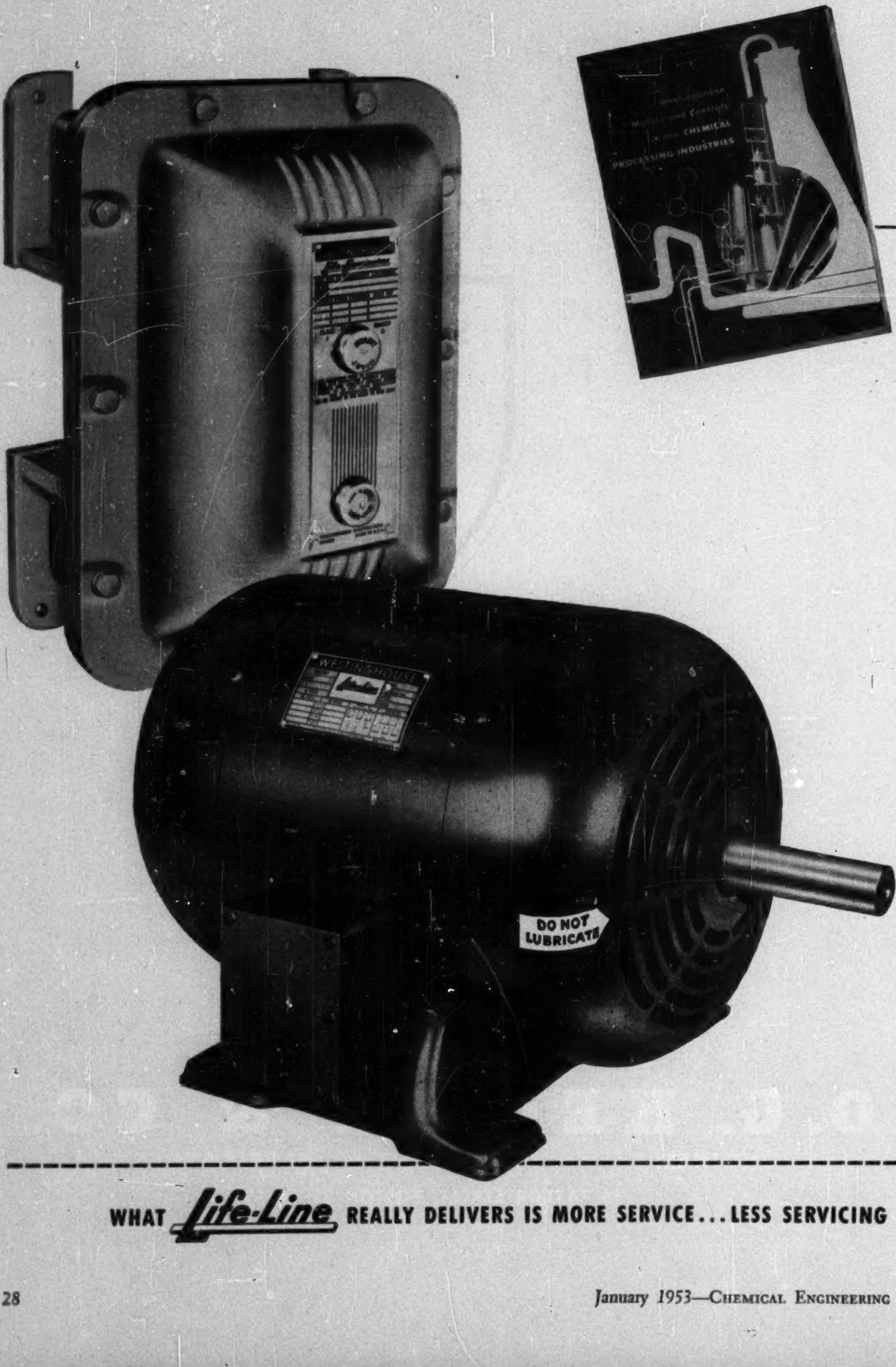

WHAT *Life-Line* REALLY DELIVERS IS MORE SERVICE . . . LESS SERVICING

New chemical booklet

answers important motor and control application problems

You'll see answers to typical problems like these:

the problem of corrosion . . . of hazardous locations . . . of dust and dirt . . . of outdoor service . . . of shock and vibration

In addition, are discussions on lubrication, maintenance, installation . . . on centralized motor and control. In fact, it is the purpose of this booklet to analyze major motor and control application problems, and to provide solutions.

Also included, is information on Westinghouse motor and control equipment for chemical processing. You'll see why Life-Line chemical motors provide the best protection . . . how starters save servicing time. A comprehensive list of available literature with data is included, plus a postage-paid reply card for your convenience in ordering additional information.

Get the facts on the most complete and most advanced line of motors and controls available today. Ask your Westinghouse representative for your free copy of "Motors and Controls in the Chemical Industries," B-4792, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-21698-A

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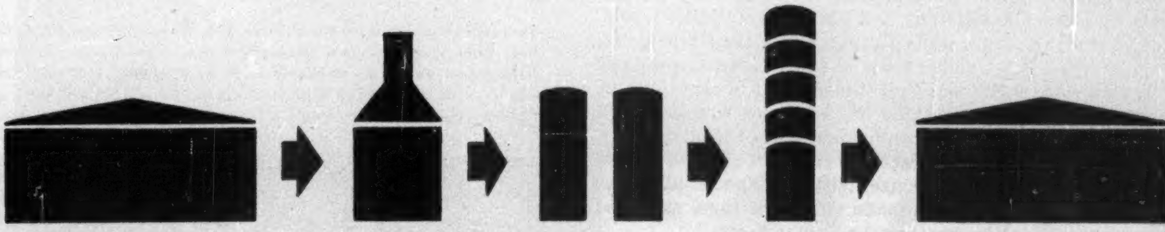
ROOSEVELT NAPHTHAS

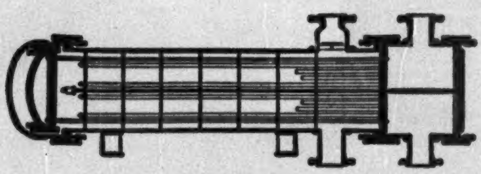
Roosevelt Naphthas are catalytically desulphurized to produce non-corrosive, chemically stable solvents with no offensive odor. And you can be sure of a constant supply of these uniformly high quality Naphthas from Roosevelt. Order standard solvents from our book of specifications or write us about your special requirements.



54

ROOSEVELT OIL AND REFINING CORP. MT. PLEASANT, MICHIGAN

in chemical installations it's ALCO for greater efficiency in heat transfer

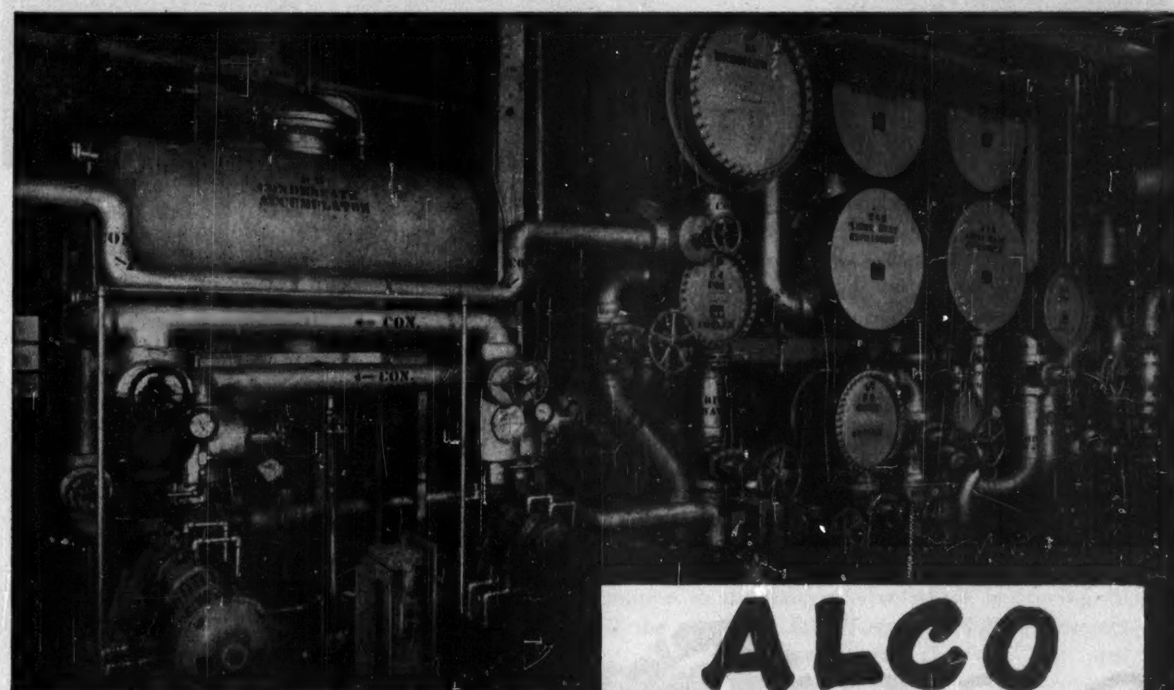


The effectiveness and versatility of ALCO heat exchangers is a matter of record—that's why ALCO enjoys leadership in production in the heat exchanger field.

Custom engineered to *your* specifications, ALCO heat exchangers range up to twelve feet in diameter; in weight, from 100 to 300,000 pounds; in pressure, from high vacuum to 3000 psi; in temperature, from minus 300 F to 1150 F. They are built to TEMA standards and to ASME or API-ASME codes.

ALCO heat exchangers are fabricated of carbon steel, nonferrous alloys, stainless steel, stainless clad, nickel-clad, or lead-lined materials. ALCO is one of the very few manufacturers qualified by experience to manufacture equipment suitable for operation at extreme *sub-zero temperatures.*

For details, contact your nearest ALCO Sales Engineer at Beaumont, Chicago, Dunkirk, Houston, Los Angeles, New York or Tulsa.



In this chemical plant, twenty-five ALCO heat exchangers meet every type of heat transfer problem from cooling amines to redistillation.

ALCO

ALCO PRODUCTS DIVISION
AMERICAN LOCOMOTIVE COMPANY
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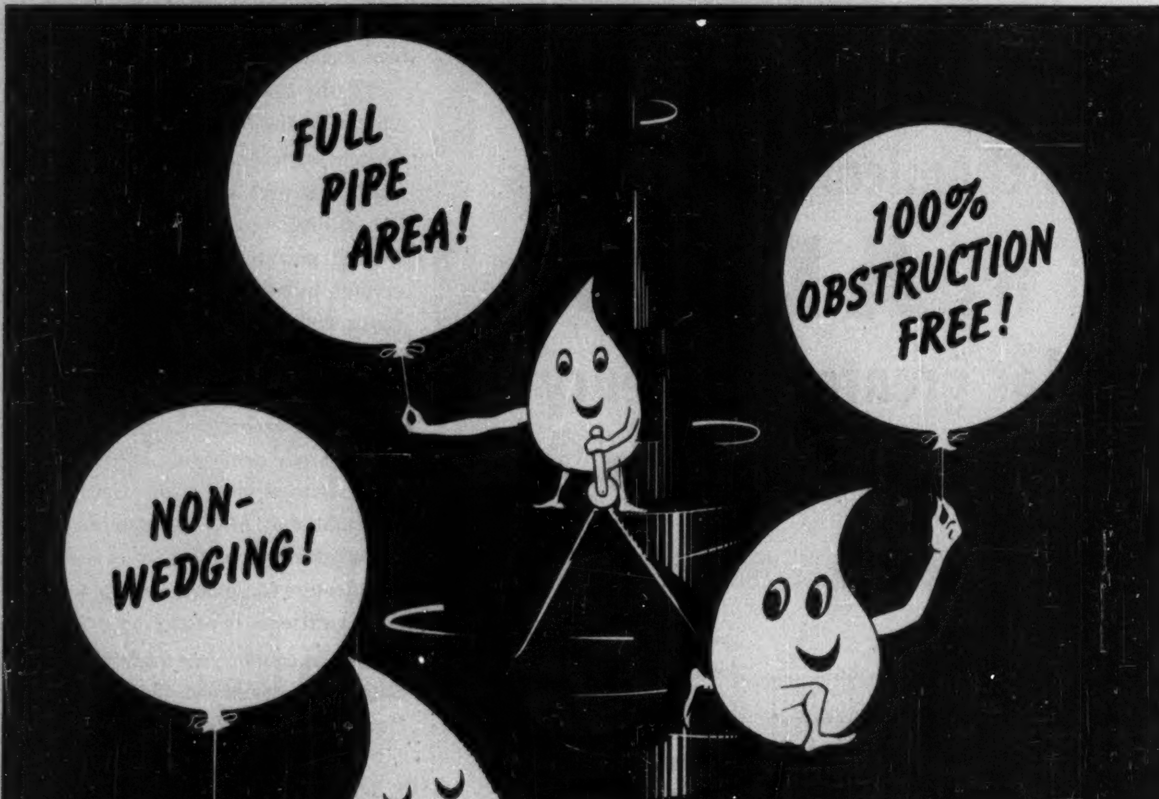
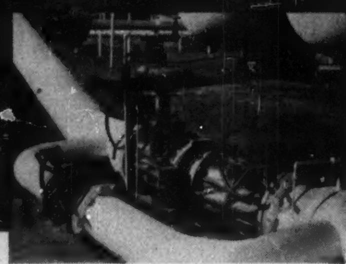
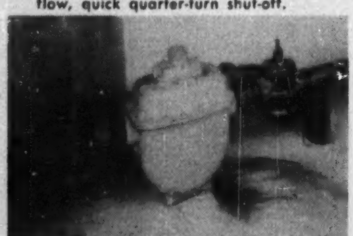


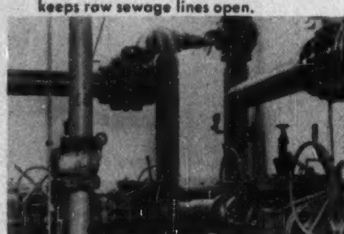


ON NATURAL GAS a.c.f. **CYLINDRICAL** Plug Valves have no obstruction to flow, quick quarter-turn shut-off.

This a.c.f. Full Round Port CYLINDRICAL PLUG VALVE—with all its sound, true economy features—is made especially for critical installations where uninterrupted, fast flow is a necessity. a.c.f. Round Port Valves are available in sizes up to 12 inches. a.c.f. Rectangular Port Valves also offer full pipe area. *And here's a new, added feature!* a.c.f. Valves are now available with TEFLON head gaskets, for easier turning, greater protection against leakage on difficult services. When next you specify, why accept less—ask for a.c.f.



IN SEWAGE PLANTS the a.c.f. Valve provides knife-edge, shearing action, keeps raw sewage lines open.



ON CHEMICALS a.c.f. Full Pipe Area stops abrasion from suspensions, no contamination of ladings.

a.c.f. CYLINDRICAL FULL PIPE AREA PLUG VALVES

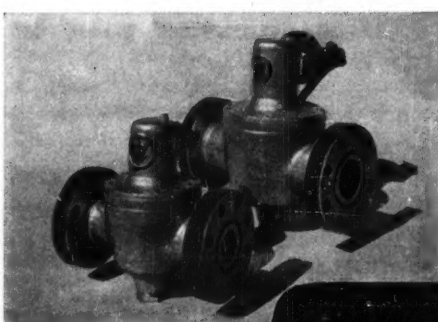
Write for Catalogue 4-CM, American Car and Foundry Co., Valve Division, 1501 E. Ferry Ave., Detroit 11, Mich.

Representatives in 50 Principal Cities

MILESTONES IN CAMERON PROGRESS

They had bugs in their bonnets

—but they sired a new champion



Along with early models of blowout preventers, Christmas trees and other oilfield products that have helped to establish Cameron as the ***world leader in pressure control,*** ancestors of the Non-Lubricated Lift Plug Valve are also proudly displayed in our own private hall of fame.

Each of these predecessors made a worthwhile contribution to the unique valve which is proving itself the champion for all sorts of difficult services in petroleum, chemical and process industries.

C. I. W., Inc., P. O. Box 1212, Houston, Texas. Export: 7912 Empire State Bldg., New York, N. Y.

World Leader in Pressure Control

PROSPERITY in the USA: Who Has It?

How prosperous *are* the people of the United States?

The previous editorial in this series answered this question for the average American. His prosperity has increased only slightly in recent years.

But the average tells only a part, and in many ways not the most important part of the story. Which individuals and groups have prospered more, which less? (The average, the result of a statistical calculation rather than a creation of flesh and blood, tells nothing about that.)

The purpose of this message is solely to get at the facts on this question of how prosperity is distributed. This is not easy. In spite of the crucial importance of the subject, the available information is limited. Even so it is possible to provide a rough answer to the question, "Who has the prosperity?"

We Have Had a Revolution

The distribution of income in the United States has changed so greatly in the past twenty years that Arthur F. Burns, Research Director of the National Bureau of Economic Research, world renowned for its impartiality and technical competence, calls it "one of the great social revolutions of history." A part of this revolution is portrayed by the following table which shows that individual incomes are both much larger and much more evenly distributed than they were twenty years ago. Clearly, a large new middle-class has been created.

DISTRIBUTION OF REAL INCOME

Dollars of Income*	Per Cent of Families in Each Income Group	
	1929	1951
Under 1,000	17%	13%
1,000 – 2,000	24	15
2,000 – 3,000	24	18
3,000 – 4,000	14	18
4,000 – 5,000	6	15
5,000 – 7,500	9	14
7,500 and over	6	7
	100%	100%

*Adjusted for price changes to give the dollar its 1951 purchasing power.

Some light on why this income revolution has taken place can be found by tracing incomes to their source. Since 1929, for instance, employees have clearly made the biggest gains in total income. This can be seen in the next table. People who own their own businesses have done second best. Farmers, who are often thought to be doing handsomely indeed, have been outstripped in the income race by employees and businessmen. People whose incomes depend upon pensions, insurance policies, and other relatively fixed returns such as rent, interest and dividends have lagged far behind.

HOW REAL INCOME HAS CHANGED*

Types of Income	Percentage Change 1929 to 1951
Wages & salaries of employees.	+123%
Income of professional men & unincorporated business	+108
Farm operators' income	+56
Rental income	+1
Dividends	+2
Interest	−35

*In this and the previous table account is taken of changes in the cost of living. But adjustment for the changing tax load was not possible, as it is in the computations which follow.

The Biggest Gains

Employees have made the biggest gains in income, but the term "employees" covers a wide assortment of people—from the presidents of the biggest corporations to factory sweepers. How have different groups of employees prospered? Some indication is provided by results of a survey of salaries in 41 corporations made by Arch Patton of McKinsey and Company and recently summarized in the *Harvard Business Review*. This survey showed that between 1939 and 1950, after adjustment both for higher living costs and for higher taxes, factory and office employees made modest gains in income while management personnel suffered losses ranging from 40% to 60%.

While factory and office workers generally have made greater income gains than others, their gains have varied greatly from industry to industry. During the past five years, for example, steel workers' take-home pay (adjusted for both taxes and price changes) has increased by 22%, that of textile workers 9%, employees of general merchandise stores 4%, and that of laundry workers not at all.

What About Organization?

How have organized workers fared compared to unorganized workers? There is no round-up of facts that makes possible a direct comparison between the two. Such evidence as there is shows it is indeed an open question whether union members have done any better than others. Steel workers, for instance, who are strongly unionized are among the highly paid manufacturing workers. Farm workers are generally not unionized, and they work in one of the most competitive industries in America.

But farm workers have made income gains which far surpass those of steel workers. Real wages of farm workers increased 2½ times more than those in the steel industry between 1939 and 1952. This fact may prove nothing more than that, in a period of inflation and manpower shortage, the less skilled workers whose incomes are ordinarily low make the biggest percentage gain in income. Further support for this conclusion is found in the construction industry where real wages of unskilled labor increased 37% between 1939 and 1952, while those of skilled labor increased only 4%.

Why Most Incomes Are Higher

Prosperity, who has it? We may conclude that workers have been getting much more of it lately than managers or property owners, that unskilled wage and salary earners have made the largest gains, and that income generally is much more evenly distributed.

Where has the money come from to raise low bracket incomes? It has come partly from an increase in the total national income, but partly also from cutting down the share received by people in the highest income brackets. While the top 5% received 33.5% of the income after taxes in 1929, their share of income has now been cut about in half. For every $11 of increase in income to the lower 95% of income receivers, about $7 has come from increased production, and about $4 by taking that amount from the top 5%.

Top bracket incomes have now been cut so deeply that the possibilities of increasing the income of the rest of the people by "soaking the rich" have largely disappeared. Indeed, if all of the income after taxes of everyone earning over $25,000 in 1951 was taken away and redistributed among the remaining Americans, each person would receive only about $65.

The significance of this revolution in income distribution is clear. It is that there is only one way by which the great mass of us Americans can continue to increase our individual prosperity. This is by earning the increase through more and more efficient production. In plotting the economic course of the U.S.A. this fact is of decisive consequence.

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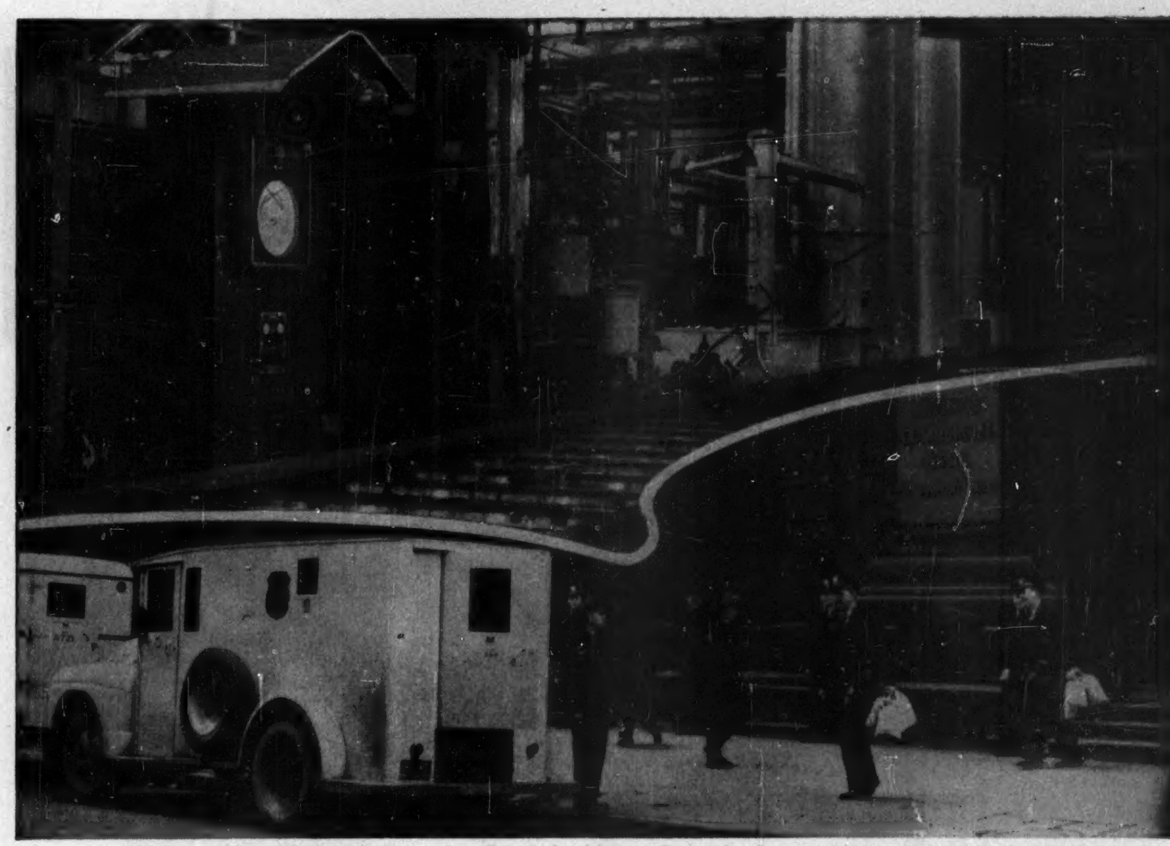


Modern Safeguards—Brink's for Money, Bailey for Process Materials

Are Your Process Materials Guarded As Well?

HERE'S HOW TO PREVENT SPOILAGE AND WASTE . . .

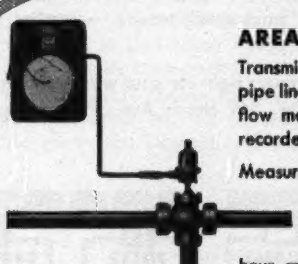
TO avoid waste of valuable process materials and finished products, process rates and conditions must be accurately measured and controlled. That's where Bailey Meters, Analyzers and Controllers can help you to improve the efficiency of your plant.

Take flow for instance. Bailey Meter Company offers a complete line of flow measuring and controlling equipment for applications ranging all the way from high pressure steam to low pressure gas. We measure flow in pipes, open channels, ducts, furnaces, smelters, kilns, ovens, dryers.

When you call Bailey Meter Company, you get the help of years of experience as well as recommendations from a wide selection of measuring and controlling devices.

Your local Bailey Engineer is as near as your telephone. He has the experience and the equipment necessary to set up an effective guard for your process materials.

P-26



AREA TYPE FLOW METER

Transmitter goes into 1, 2 or 4 inch pipe line like a valve and transmits flow measurements electrically to recorder in remote location.

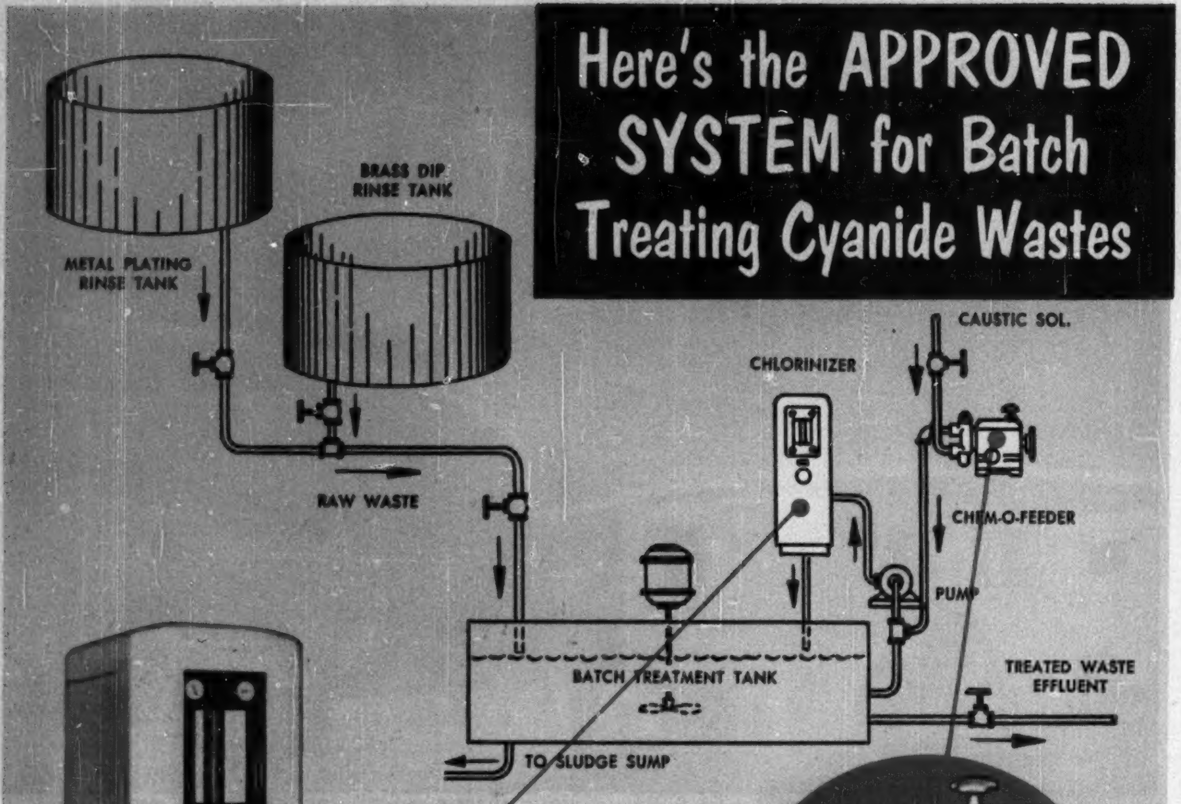
Measures oil and other clear liquids under static pressures up to 600 psi. Minimum range 0 to 1200 lb. per hour, maximum range 0 to 9600 lb. per hour.

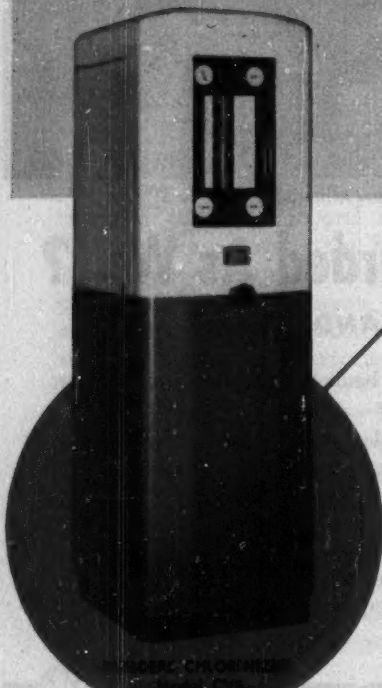
BAILEY METER COMPANY

1054 IVANHOE ROAD
CLEVELAND 10, OHIO

Process Controls TEMPERATURE · FLOW
PRESSURE · LEVEL
GAS ANALYSIS · RATIO

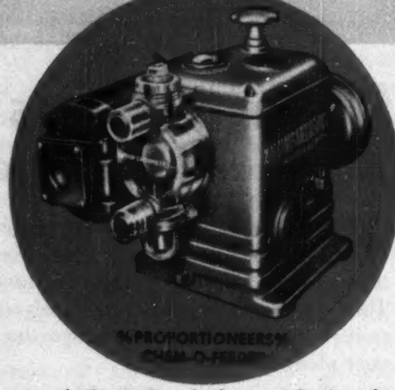
Here's the APPROVED SYSTEM for Batch Treating Cyanide Wastes





. . . ideal chlorine gas feeder for reducing cyanide wastes. Safe, simple, highly dependable — Chlorinizer can be easily operated by regular plant personnel.

This automatic, low-cost system is simplicity itself. It's the B-I-F Industries *approved system* for batch treating cyanide wastes. Practical, workable, this system represents the combined engineering knowledge and field experience of Builders-Providence, Inc., %Proportioneers, Inc.%, and Omega Machine Company — three major suppliers of equipment for automatic processing, flow measurement, and continuous process control.



. . . feeds caustic soda for neutralization of acid wastes. Gives exact liquid feed required — operates virtually without any attention or maintenance.

This and the many other B-I-F Industries *approved systems* can help you solve *your* waste treatment problem, whether your business involves meat packing or metal working, distilling or dye making, pharmaceuticals or fish processing. We offer you a complete, "packaged" service — worked out in cooperation with your consulting engineer.

For information about the "package" that's right for your waste treatment problem, write B-I-F Industries, Dept. TW, 369 Harris Ave., Providence 1, Rhode Island.

B-I-F INDUSTRIES — 1853 — A CENTURY OF QUALITY

BUILDERS OMEGA %PROPS%

Widest choice . . . for engineered instrumentation

EACH of the thousands of industrial processes presents its own peculiar problems of measurement and control. Naturally, no single instrument can solve all of these varied problems. Serious compromises would have to be made in performance, convenience, and cost.

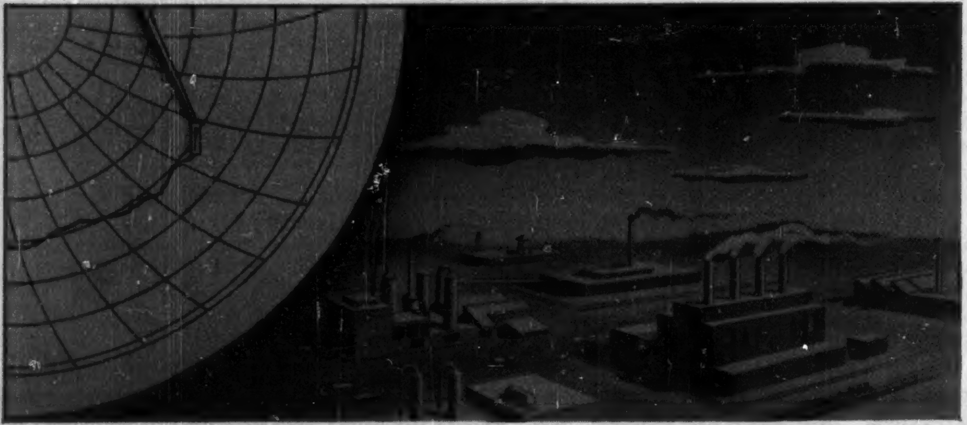
The many Honeywell primary elements, instruments, control systems, and final control elements constitute a uniquely complete family, covering practically the whole spectrum of industrial measurement and control. You can be sure that the combination selected for your job is recommended without bias, and with full consideration for every need of the application.

Included are *ElectroniK* instruments for indicating, recording and controlling a host of variables, in circular and strip chart models; *Tel-O-Set* miniature indicators, recorders and controllers; *Pyr-O-Vane* millivoltmeter controllers; square root and linear flow meters; thermometers; pressure gauges. Electric and pneumatic control systems range from the simplest to the most complex, including fully automatic program control. Primary elements include thermocouples, thermometer bulbs, *Radiamatic* elements, pH assemblies, conductivity cells, flow meter bodies and many others. For final control elements, there is a full range of motorized and diaphragm operated valves. Supplementing these are more than 7000 different non-indicating devices for controlling temperature, pressure, vacuum and other conditions.

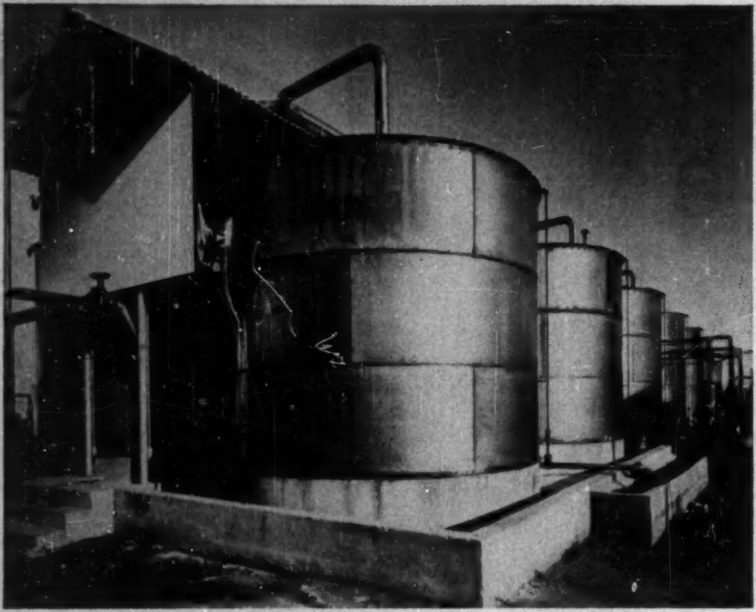
"Building block" approach

These are the building blocks of measurement and control. To combine them into systems custom-fitted to your process, Honeywell offers the know-how gained through years of experience in all branches of industry. Whether your process calls for a single instrument or a complete central control panel, you can be sure of getting the peak in performance and value . . . and the advantages of a single responsibility for the entire installation . . . when you specify *engineered instrumentation by Honeywell.*

Engineered to Lever



COMPLETE COVERAGE *of industrial requirements for instrumentation is at your command in the Honeywell line. Whatever you need to measure or control . . . to any accuracy . . . with any of a variety of special features . . . you'll find Honeywell instruments offer the most efficient solution.*



Some of the 24 Monel Twitchell splitting vessels installed by the Southern Cotton Oil Company. These tanks have been in service four years and have required minimum maintenance. Approximately 120,000 pounds of 0.125" sheet Monel was used to fabricate the self-supporting fat-splitting tanks.

These fat-splitting tanks

ended leakage—ended caulking

... for Southern Cotton Oil Company

After four years, the Southern Cotton Oil Company is still getting excellent service from those tanks—but that's just what you would expect of Monel®!

The Twitchell splitting vessels they had used previous to Monel had often required attention involving caulking of riveted joints and repairing at the seams to prevent leakage.

With the welded Monel tanks they have had none of this expensive and time-consuming maintenance.

And there is good reason why they are so pleased with their installations.

In addition to being highly resistant to hot corrosives encountered in Twitchell splitting, their Monel vessels do not introduce undesirable metallic contamination . . . an important consideration with today's standards of product purity.

As a fabricating material, Monel offers important mechanical advantages, too. It is stronger than structural steel, hard, tough, yet ductile enough to permit easy forming and machining. Monel can be joined by soldering, brazing, or welding, and welds in Monel are as corrosion-resistant as the alloy itself.

Prominent manufacturers of stearic acid, red oil, glycerine and allied chemicals report service records up to eleven years for Monel tanks and heating coils.

Consult your Distributor of Inco Nickel Alloys for the latest information on their availability from warehouse and mill. Remember, too — it always helps to anticipate your requirements well in advance.

And for help with problems connected with the manufacture and handling of fatty acids, remember you can always count on Inco's Technical Service and Corrosion Engineering Section. Write them today. The International Nickel Company, Inc., 67 Wall Street, New York 5, N. Y.

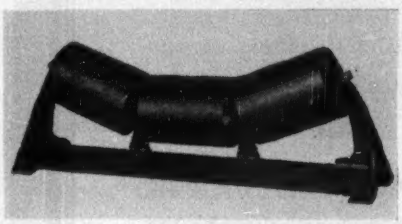
Inco Nickel Alloys

INCO TRADE MARK

Monel . . . FOR MINIMUM MAINTENANCE

THIS JEFFREY BELT CONVEYOR

Effects Marked Modernization In This Large Limestone Plant



One of the Jeffrey 3-roll Belt Idlers, mainstay of the Belt Conveyor system. They are rugged and built to give years of reliable service. Various sizes for the job at hand.

It conveys crushed limestone (1¼"-0") up a 60-foot incline at 125 tons per hour. 500-foot center, this conveyor runs at 227 F.P.M. — 30 H. P. motor. Provides continuous operation with little maintenance.

Jeffrey engineers are constantly effecting marked modernization of material handling methods in the many fields Jeffrey is privileged to serve. It's a story of specialization . . . of painstaking "care" which has constantly attended the development of Jeffrey equipment.

Also on this job are Jeffrey Spiral Conveyors, Bucket Elevators, Feeders and allied machinery. Our engineers are in a position to help you satisfy each new demand in a practical manner. Write today.

THE JEFFREY

1877 75 1952

MANUFACTURING COMPANY

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The Galion Iron Works & Mfg. Co., Galion and Bucyrus, Ohio
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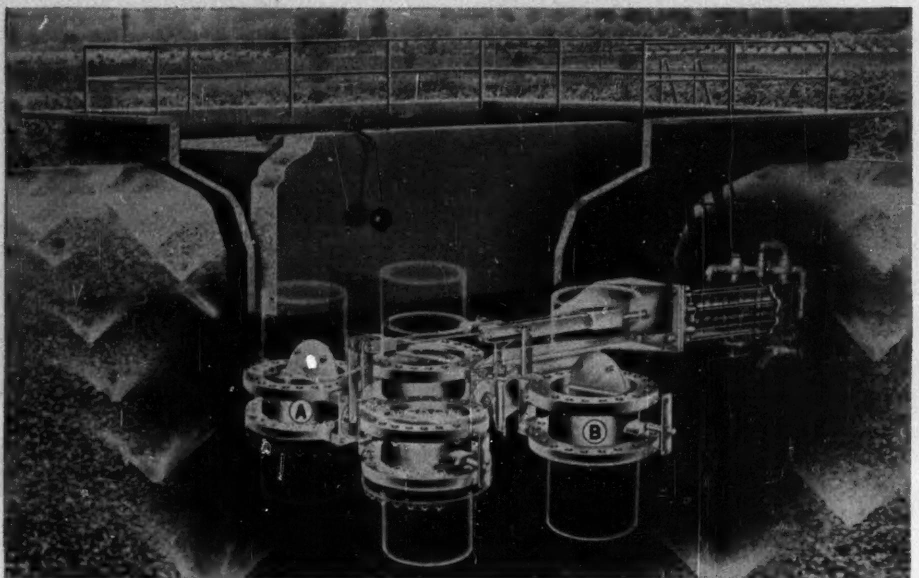
The Ohio Malleable Iron Co., Columbus, Ohio

R-S valvEvents

· EXCERPTS FROM THE R-S BOOK OF EXPERIENCE ·



R-S Simplified Sewage Control System

This dosing pit control system is located in the Ontario-Upland, California, sewage treatment plant. In continuous operation day and night for over two and one-half years, it shows the tandem cycling of the valves which occurs every four minutes.

The system consists of four twenty-four inch heavy duty R-S Valves operated by a single water cylinder through cross linkage. While the far pit is filling through valve (A), the near pit is draining through valve (B) and discharging through the spray nozzles. As soon as the far pit is full, the float control will actuate the water cylinder by means of air operated three way valves, thus draining the pit and filling the near pit at the same time. Handwheel operation is provided for emergency use.

Rugged construction with minimum friction means long life and trouble-free operation for R-S Valves.

Consult your local R-S Valve Engineers, or write direct.

R-S PRODUCTS CORPORATION • 4600 Germantown Ave., Philadelphia 44, Pa.

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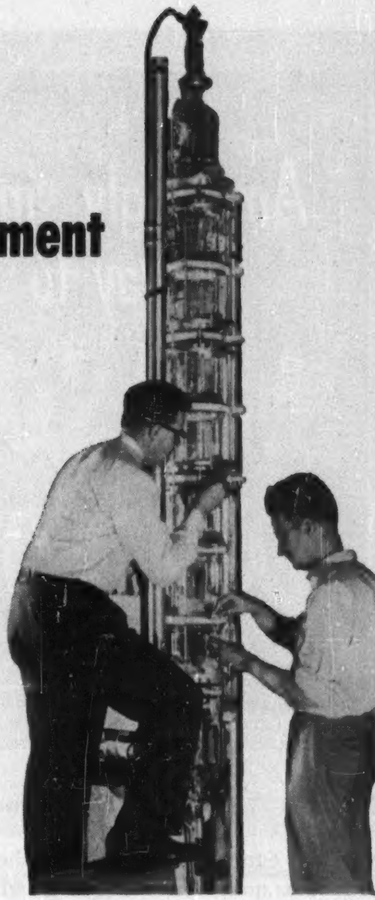
DISTRICT OFFICES IN PRINCIPAL CITIES

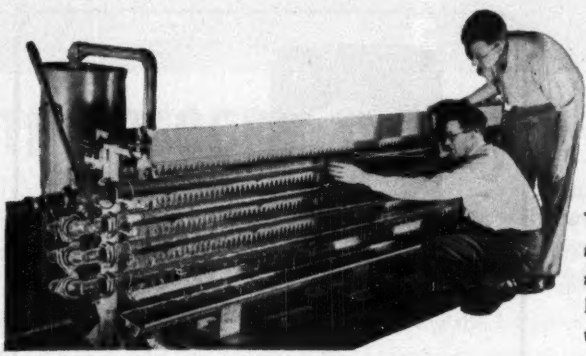
Acids can't eat away your PYREX® GLASS processing equipment



Dollar for dollar, no other material has the all-around corrosion resistance of PYREX brand glass No. 7740. Its exceptional mechanical and thermal properties make it ideal for coolers, condensers, fractionating columns, piping and other processing equipment.

What's more, the chemical stability of this PYREX glass provides positive protection against contamination of pharmaceutical and other sensitive products. Transparency permits you to keep an eye on processes—spot defects at a glance. Easy cleaning, another important advantage, results from the hard, smooth surface of glass.

These are only some of the more important reasons why PYREX brand glass pipe, cascade coolers, fractionating columns and other processing equipment pay for themselves many times over. It will pay you to check with Corning.



Pyrex® Cascade Coolers give you two important advantages

The over-all corrosion resistance of PYREX brand cascade coolers offers you two distinct advantages. First, it prevents chemical attack inside the tubes—thus increasing service life. Second, it permits the use of low-cost river or sea water as a coolant.

Low in first cost per BTU transferred, cascade coolers add further economy because the hard, smooth surface of glass limits scale build-up, reduces fouling.

Highly versatile, they can be mounted on floor, wall, or ceiling to conserve space. Shipped complete, a multi-tube unit can be quickly assembled by your own men.

For heat transfer nomographs, tables and description of PYREX cascade coolers, send for Bulletin PE-8.

Corning means research in Glass

Good throughput with Pyrex® Columns

You get unusual advantages in solving fractionating and absorption problems with PYREX brand glass fractionating columns. Corrosion resistance assures long service life, low replacement costs. Transparency permits you to observe flow and performance at any stage. Exceptional physical and thermal durability minimize breakage hazards.

Available in 4" and 6" sizes with any number of plates, PYREX fractionating columns have a throughput of 20 to 25 gallons per hour. Gas and liquid samples may be taken at any time without disturbing operation.

Get full information on PYREX fractionating columns and standard packed columns by sending for Data Sheets.

Corning Glass Works
Dept. CE-1, Corning, N. Y.

PYREX

Please send me:

- ☐ Bulletin PE-8, PYREX brand Cascade Coolers.
- ☐ Data Sheets for PYREX brand Fractionating and Packed Columns.

Name..........

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Company..........

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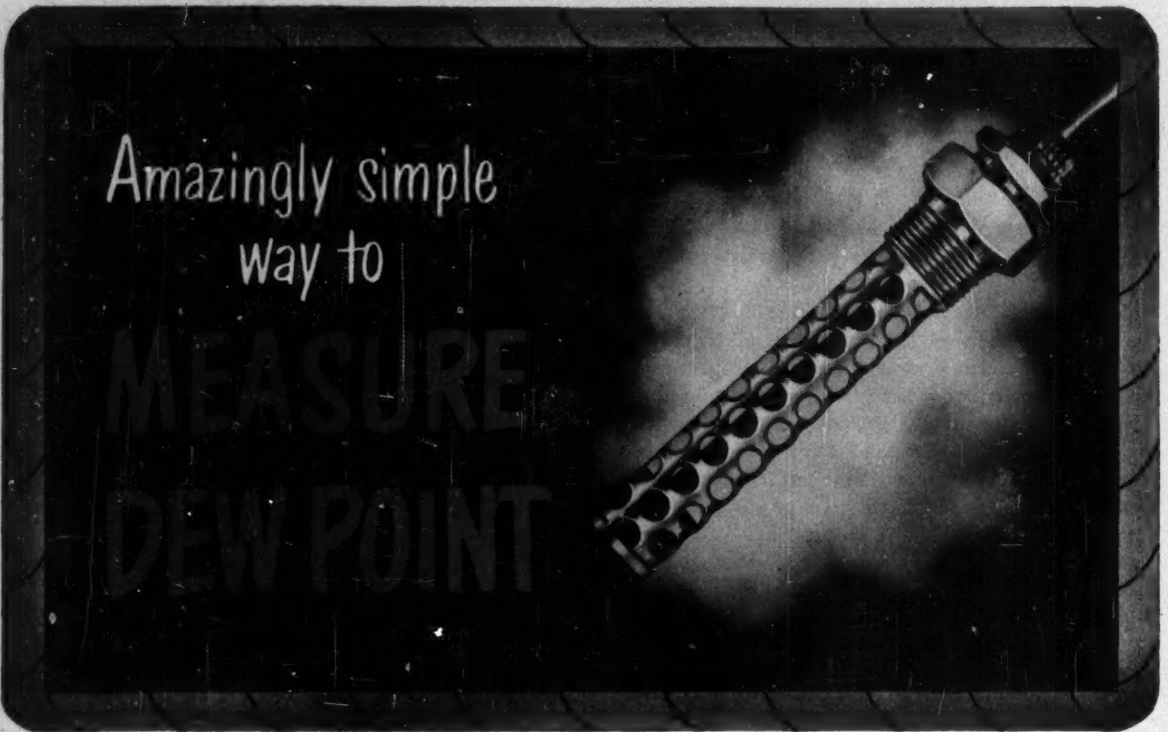
City.......... Zone.......... State..........



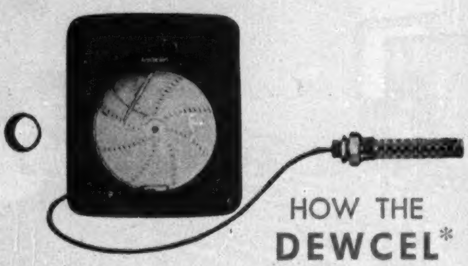
directly . . . accurately . . . continuously

Now you can measure or control the humidity of air or process gases with simplicity and accuracy never before obtainable!

An entirely new-type humidity-sensitive element, the exclusive Foxboro Dewcel*, opens many new possibilities for product improvement in industry. Coupled with a Foxboro Recorder or Controller, the Dewcel offers these outstanding advantages:

1. Direct recording in dew point temperature, at existing pressure.
2. Wide working range — even operates at sub-zero temperatures.
3. Neither adds nor removes water from atmosphere.
4. No water box or circulation of air required.
5. Simplicity that eliminates maintenance.
6. High sustained accuracy.
7. Initial and operating economy.

Investigate Foxboro Dew Point Control for your process. In successful use in nuclear fission, pharmaceutical, food and chemical plants, distilleries, photo film production, drying and storage operations. Write for Bulletin 407. **The Foxboro Company, 361 Neponset Ave., Foxboro, Mass., U.S.A.**



HOW THE DEWCEL* WORKS

The Dewcel element is a thermometer bulb (liquid-filled or electric-resistance type) jacketed with lithium-chloride-impregnated woven glass tape. Over this are wound two spaced gold or silver wires connected to an AC source. The lithium chloride absorbs moisture, allowing current to flow, generating heat, and raising the temperature. Equilibrium temperature is reached when vapor-pressure of the moist salt exactly balances that of the surrounding air or gas. The System translates this temperature into direct readings of dew point.

Thus, Foxboro Dew Point Instruments give direct readings or control of dew point from —50°F. to 142°F. at working temperatures from —40°F. to 220°F. Readings easily converted to absolute or relative humidity.

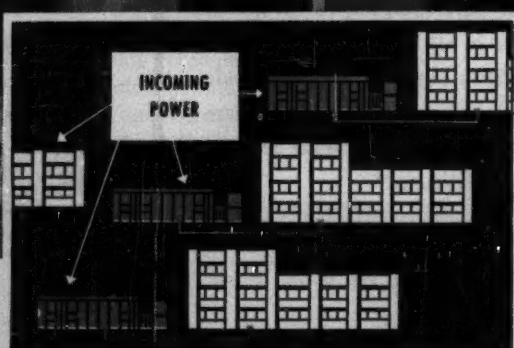
*Trade Mark

FOXBORO

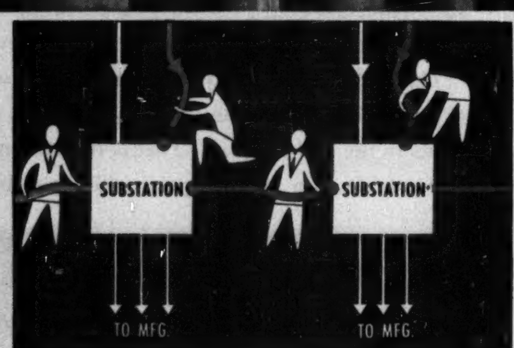
RECORDING · CONTROLLING · INDICATING

INSTRUMENTS

FACTORIES IN THE UNITED STATES CANADA, AND ENGLAND



To handle the big Willow Island plant expansion, American Cyanamid spotted 10 power substations throughout the manufacturing area. When new buildings are added, new substations will be installed without interfering with production in the existing buildings.



When the plant is expanded, the new substations will also be connected into the "secondary network". This improves system capacity and reliability because substations share the load. If you want benefits like these, have Westinghouse help plan *your* next power system.

AT YOUR END OF THE
COAL CHEMICAL PIPELINE . . .

from Sun, Sea and a Plastic Ball—

Fresh Water!

HERE'S American scientific ingenuity at its best . . . a plastic ball that makes life-saving fresh water from the sun and the sea. The principle is simple: Solar heat evaporates sea water from a black "wick" and the distilled vapors condense on the cooler inner surface of the sphere.

But one of the real challenges was to produce a vinyl plastic that wouldn't succumb to salt water, heat and long storage. That was a job for a good *plasticizer*. As a basic producer we're continually being called upon for plasticizers to meet every demand, from low temperature flexibility in Arctic-bound military coverings to high stability in surgical tubing. Whatever the challenge, plastics manufacturers have learned to count on the uniform high quality of Pittsburgh PX Plasticizers . . . an advantage that accrues from our unique coal-to-finished plasticizer production control. This same *assurance of quality* carries right through the products of our other integrated divisions . . . because we're *basic*.

WBD 4414

DiButyl Phthalate
DiIsoOctyl Phthalate
DiOctyl Phthalate
DiNonyl Phthalate
DiNonyl Adipate
DiIsoOctyl Adipate
DiOctyl Adipate
DiButyl Sebacate
DiIsoOctyl Sebacate
DiOctyl Sebacate
TriCresyl Phosphate
TetraHydroFurfuryl Oleate

PLASTICIZER DIVISION
PITTSBURGH
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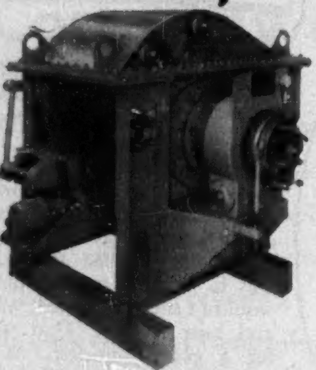
COAL CHEMICALS • AGRICULTURAL CHEMICALS • FINE CHEMICALS • PROTECTIVE COATINGS • PLASTICIZERS • ACTIVATED CARBON • COKE • CEMENT • PIG IRON

A COMBINATION OF CORROSION PROBLEMS

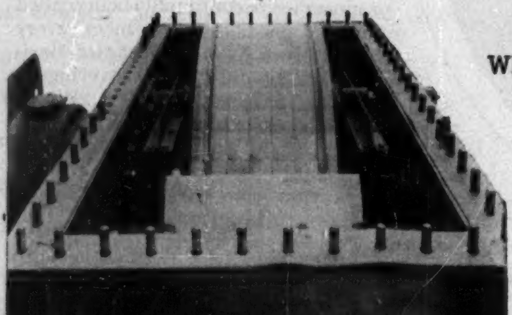
—all solved with *Carpenter* materials



sulphuric acid, nitric acid and potassium permanganate safely handled by Stainless #20

The materials handled by this continuous vacuum filter are not only corrosive but toxic. The principal corrodent in the filtrate is sulphuric acid (PH1). The solutions used for periodic cleaning of the filter are nitric acid and potassium permanganate.

To withstand this combined attack, all parts of the filter that come in contact with slurry, cake or filtrate are made from Carpenter Stainless #20—sheet, pipe, nipples, electrodes, rounds, etc. The hood to contain the gases is made from Carpenter stainless sheet, type 316.



Wherever corrosion is a problem, it will pay you to get in touch with your nearby Carpenter Distributor. He can put at your disposal our 25 years of experience in providing materials to withstand corrosion and the necessary "know-how" to fabricate them easily. The Carpenter Steel Company, Alloy Tube Division, Union, N. J.

Export Dept.: The Carpenter Steel Co., Port Washington, N.Y. "CARSTEELCO"

New 16-Page Book of Technical Data

For complete information on No. 20 and the jobs it can do, write us a note on your company letterhead and ask for the new Carpenter Stainless No. 20 book.

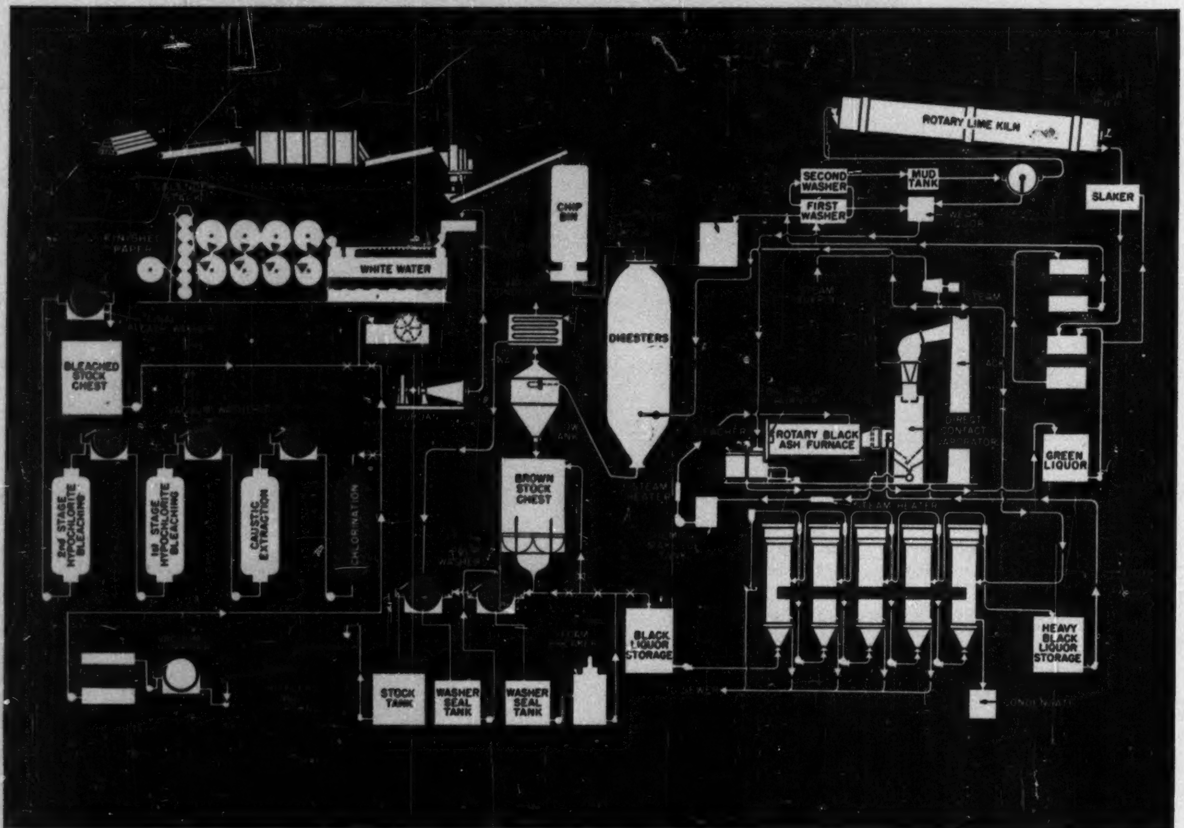
Carpenter

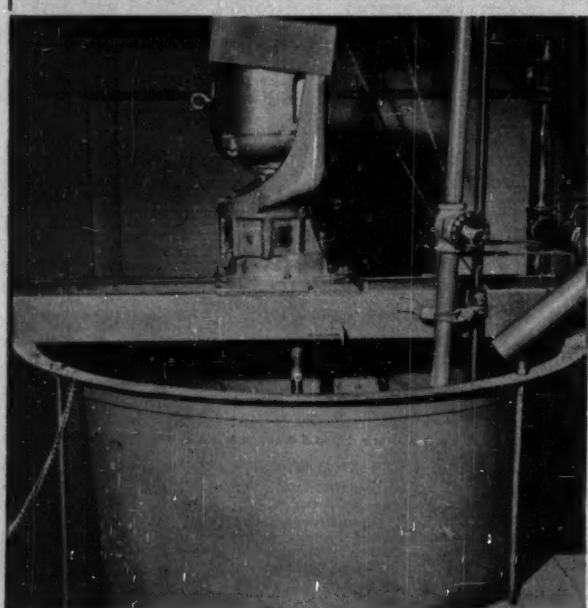
STAINLESS TUBING & PIPE

Analysis — Tolerance — Finish

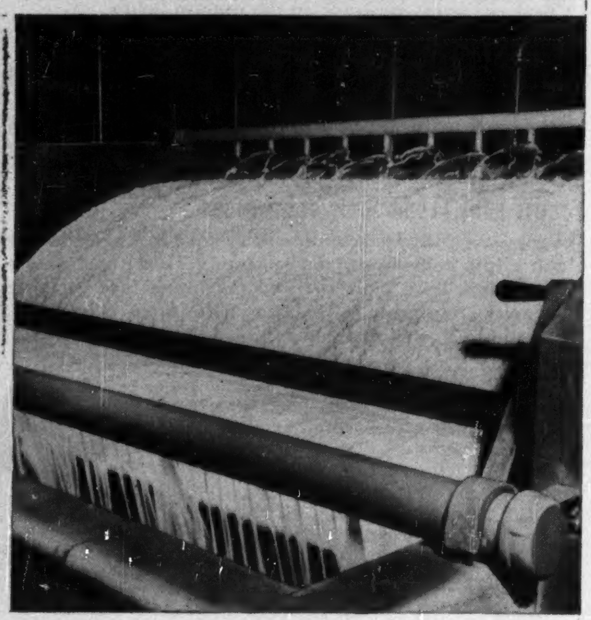
• guaranteed on every shipment

How P. H. GLATFELTER COMPANY





ANOTHER USE of Stainless Steel at the P. H. Glatfelter Co., Spring Grove, Pa., is this starch mixing tank. The agitator, as well as the tank proper, is Stainless Steel.



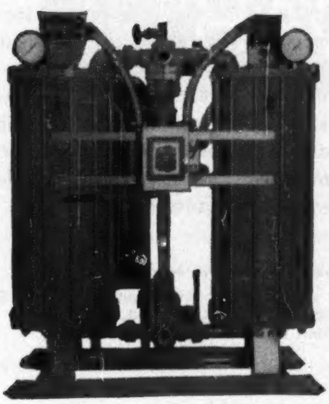
THE WIRE AND ROLLS on this black liquor washer are made of Stainless Steel to resist the corrosive effects of the pulp and cooking liquor as it comes from the digester.


Here's the hookup
for valve-killing
corrosive services...
Stainless Steel
PLUS
Jenkins Quality
TRADE JENKINS MARK
To end high valve mortality from corrosive liquids, and to control fluids that must be kept free from contamination or discoloration, stainless steel is the right metal. But it takes more than metal to make a valve. For dependable performance, you need the two-way hookup—Stainless Steel *and* Jenkins time-proved Valve Engineering.
With the increased demand for processing equipment that resists corrosion, more and more Stainless Steel Valves have been added to the Jenkins line. It now includes types and sizes to meet most industrial needs.
Look for the famous Diamond trade-mark on valves of stainless steel. As on *any* Jenkins Valve, it means extra years of trouble-free service.
Send for this folder, Form 194, describing the complete line of Jenkins Stainless Steel Valves. It contains specifications and other important data that will help you select the *right* valves for your plant. Jenkins Bros., 100 Park Ave., New York 17, Jenkins Bros., Ltd., Montreal.
JENKINS
LOOK FOR THE DIAMOND MARK
VALVES
SINCE 1864
TRADE JENKINS MARK
SOLD THROUGH LEADING INDUSTRIAL DISTRIBUTORS EVERYWHERE

On the Platte Pipe Line...

5 Lectrodryers at Cadoma, Wyoming 3 Lectrodryers at Wymore, Nebraska 1 Lectrodryer at Salisbury, Missouri

DRY air supplied by Lectrodryers* keeps automatic controls awake 24 hours a day



This type of Lectrodryer is used on the Platte Pipe Line; proved dependable in many years of service.

Designers who planned the Platte Pipe Line are taking no chances that moisture will get into instrument air lines and foul up controls. They feed DRY air to their instruments—air dried by Lectrodryers. There'll be no water in their lines to cause freeze-ups, form mud and rust to clog delicate instrument ports.

Lectrodryers catch the vaporous moisture which gets by aftercoolers, separators and filters. They're at work in petroleum refineries, chemical processing and power plants, as well as oil and gas pipe lines, all over the world. They're DRYing compressed air to low dew-points, keeping controls functioning properly.

Whether your moisture problem concerns instrument air, materials being processed or air in workrooms and storage areas, there are Lectrodryers to solve it. Write, telling your troubles with unwanted moisture, to Pittsburgh Lectrodryer Corporation, 325 32nd Street, Pittsburgh 30, Pennsylvania.

In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
In Australia: Birlec, Limited, 51 Parramatta Road, Glebe, Sydney.
In France: Stein et Roubaix, 24 Rue Erlanger, Paris XVI.
In Belgium: S. A. Belge Stein et Roubaix, 320 Rue du Moulin, Bressoux-Liege.

LECTRODRYERS DRY WITH ACTIVATED ALUMINAS

LECTRODRYER

*REGISTERED TRADEMARK U.S. PAT. OFF.

Combined for Service and Savings:

AUTOMATIC CONTROL

and INSTRUMENTATION

by HAGAN

Hagan Engineers have developed automatic control equipment and instruments which can be assembled into coordinated systems designed to meet your particular requirements. For example:

HAGAN AIR-OPERATED AUTOMATIC CONTROL EQUIPMENT includes pressure measuring and control units which may be combined into automatic control systems for process industries, metallurgical furnaces and steam power plants.

HAGAN RING BALANCE FLOW METERS are the most versatile meters available. Hagan Meters indicate, record, and integrate one or two flow rates. Standard modifications provide for pressure and temperature compensation. Ring assemblies are available to measure pressure differentials from 20″ to 140″ WC at static pressures up to 15,000 psig, and from 40″ to 420″ WC at static pressures to 3,000 psig.

THE SPECIAL APPLICATION DIVISION is equipped to design and fabricate force measuring devices and coordinated control and metering systems for aeronautical testing facilities, and for automotive and process plants. Examples include automatic control of simulated flight conditions in supersonic wind tunnels and altitude test chambers, control systems for gas turbines, thrust stands for full power test of planes, dynamometer testing and automatic batch weighing.

WRITE, WIRE or PHONE today for information about how Hagan Engineers can help you solve your industrial control and instrumentation problems.

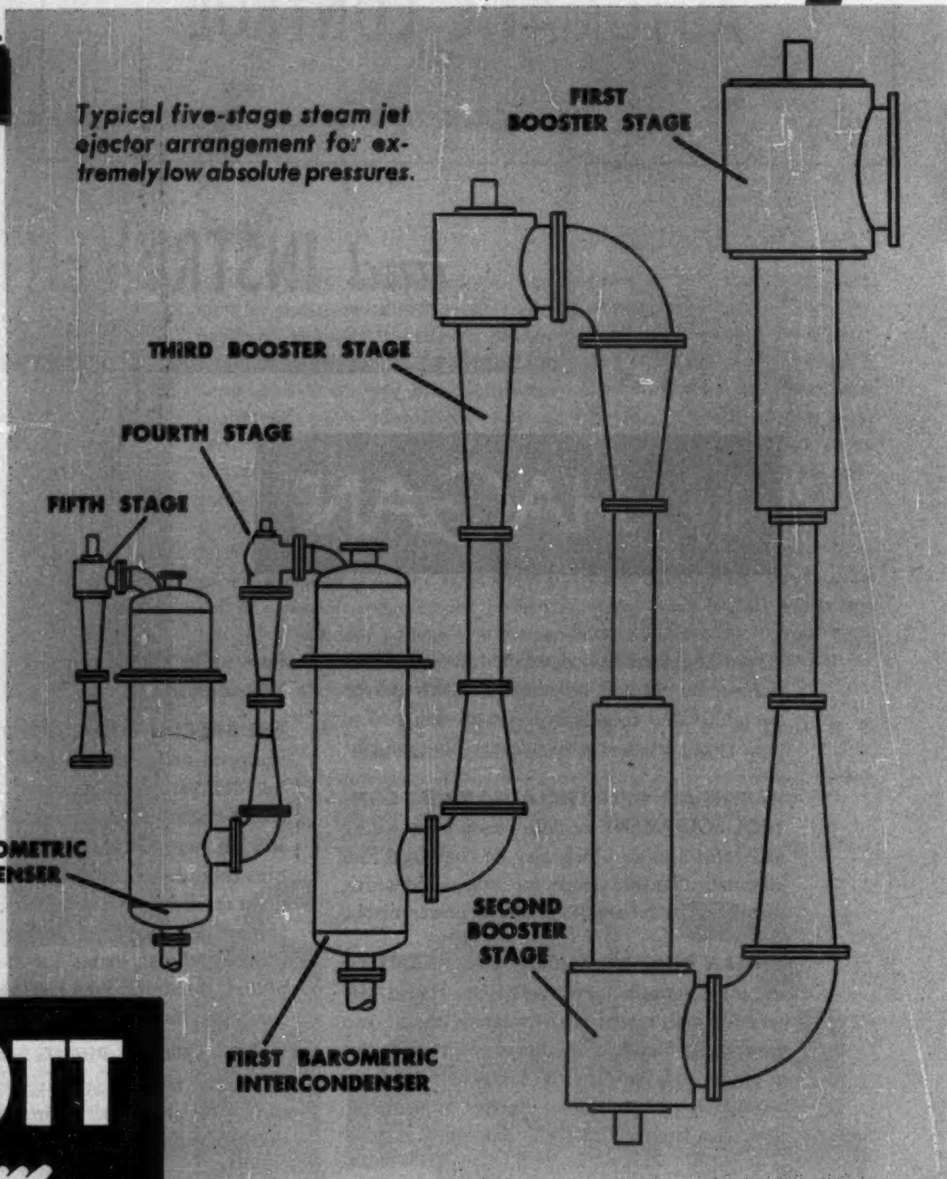
HAGAN CORPORATION

HAGAN BUILDING
PITTSBURGH 30, PENNSYLVANIA

BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
CONTROL SYSTEMS FOR AERONAUTICAL
AND AUTOMOTIVE TESTING FACILITIES

HAGAN
HALL
BUROMIN
CALGON

Vacuum by



Typical five-stage steam jet ejector arrangement for extremely low absolute pressures.

ELLIOTT
Steam Jet
EJECTORS

ELLIOTT

INDUSTRIAL PROCESS

G3-1

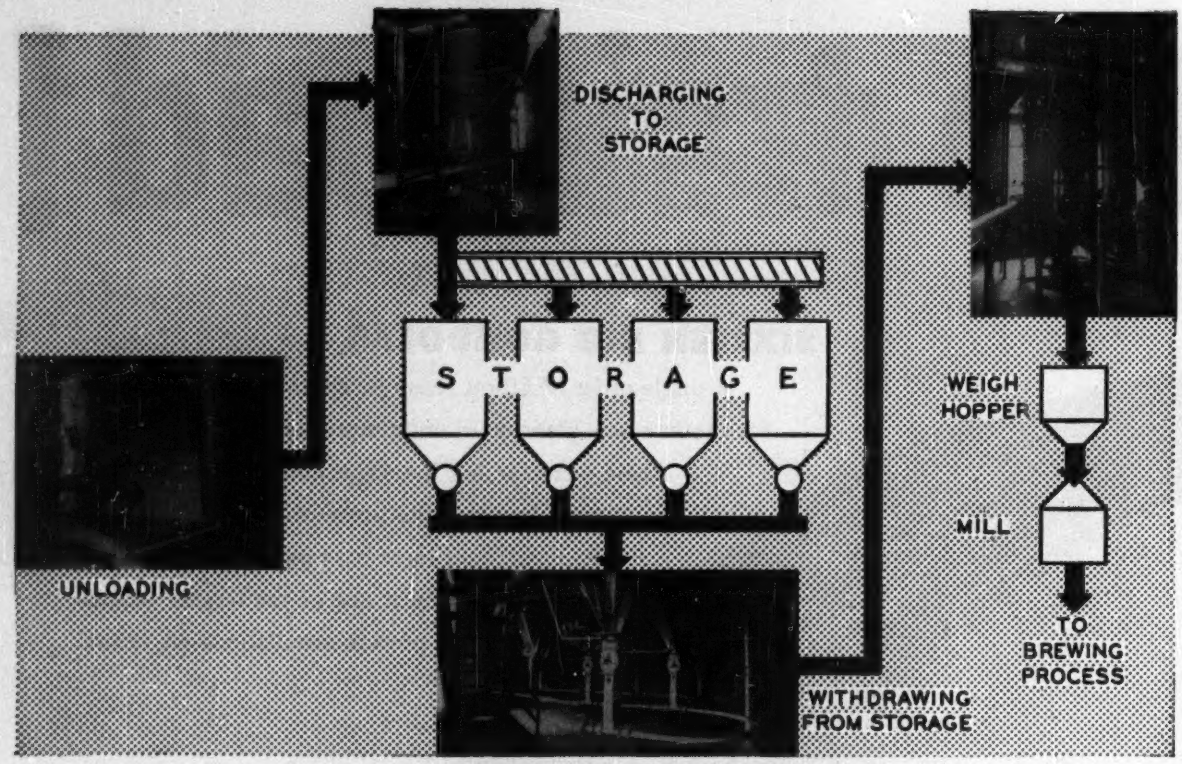
the trainload!

SIXTEEN BIG GONDOLAS were needed to convey a single order of Elliott steam jet ejectors recently shipped for use in a new plant of an important chemical company. All these were for big five-stage units, for maintaining very low absolute pressures. There are sixteen of these big units in this operation, making it one of the largest vacuum process installations on record.

Elliott ejectors cover the entire range of commercially obtainable vacuum, from the single small priming ejector to the huge multi-stage unit with intercondensers as shown on the facing page, which can supply absolute pressures ranging from .012 in. to about .003 in. mercury. Elliott engineers have had broad and successful experience in fitting ejector installations to specific operating conditions and requirements in amount of vapors and noncondensable gases to be handled. Use this experience, without obligation. For full information and descriptive bulletins write Elliott Company, Jeanette, Pa.

Company

DIVISION



Materials flow diagram shows reason for "No Hands" operation at Centlivre. From transport to process, grains are handled automatically by Dracco Airstream Conveyor.

Airstream ESTABLISHED "NO HANDS" PROCESSING AT CENTLIVRE

An automatic Dracco Airstream Conveyor system has eliminated all manual handling of grain, grits and malt at the Centlivre Brewing Corporation in Fort Wayne (Indiana) where "Old Crown" beer is "lazy-aged" to tasty perfection.

From incoming transport to cooker, the grains in this modern brewery are moved by Airstream in a swift, sanitary operation. They are (1) unloaded to bin storage, (2) conveyed from storage to automatic weighing in scale hoppers, and (3) transported to the brewing process. These are accomplished accurately and efficiently with a great reduction in the cost of physical labor and its unavoidable errors.

If you have a handling problem involving dry granular or powdered materials, Dracco techniques and Dracco equipment can provide a cost-saving solution. Why not call in a Dracco engineer today? There is no obligation.

DRACCO CORPORATION
Harvard Ave. and E. 116th St., Cleveland 5, Ohio

For further information on handling bulk materials with Dracco Airstream Conveyors write Dept. C-1, Cleveland 5, Ohio. Ask for Bulletin 529.

DRACCO

Performance Proved

Airstream **CONVEYORS · DUST CONTROL EQUIPMENT**

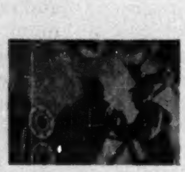
Made to measure up when the going is tough!

M. W. KELLOGG

Large and small vessels for handling unusual corrosives . . . extrem in high and low temperature operations . . . high vacuum to high pressure—the are the vessels that refiners time after time "earmark" for Kellogg, becau Kellogg-fabricated vessels measure up when the going is tough.

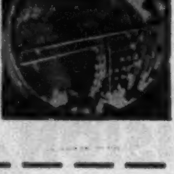
- Pressure Vessels
- Vacuum Vessels
- Fractionating Columns
- Drums and Shells
- Heat Exchangers
- Process Piping
- Hi-pressure—Hi-temp Power Piping
- Bends and Headers
- Forged and Welded Fittings
- Radial Brick Chimneys
- Concrete Chimneys

Continuing Study of behavior of metals under stress at high temperatures has produced valuable design data.



Shop Layout Craftsmen are fully experienced in vessel fabrication from nozzle positioning to "knockdown" fabrication for field assembly.

Extensive Facilities from bending of plate to final machining of precision surfaces permit complete fabrication under the same roof.



Special Welding Techniques and stress relieving methods assure equipment performance even under severest operating conditions.

Rigid Quality Control, devised by specialists, including chemical and micro analyses as well as mechanical and non-destructive testing.

FOR OPERATORS IN WESTERN CANADA!

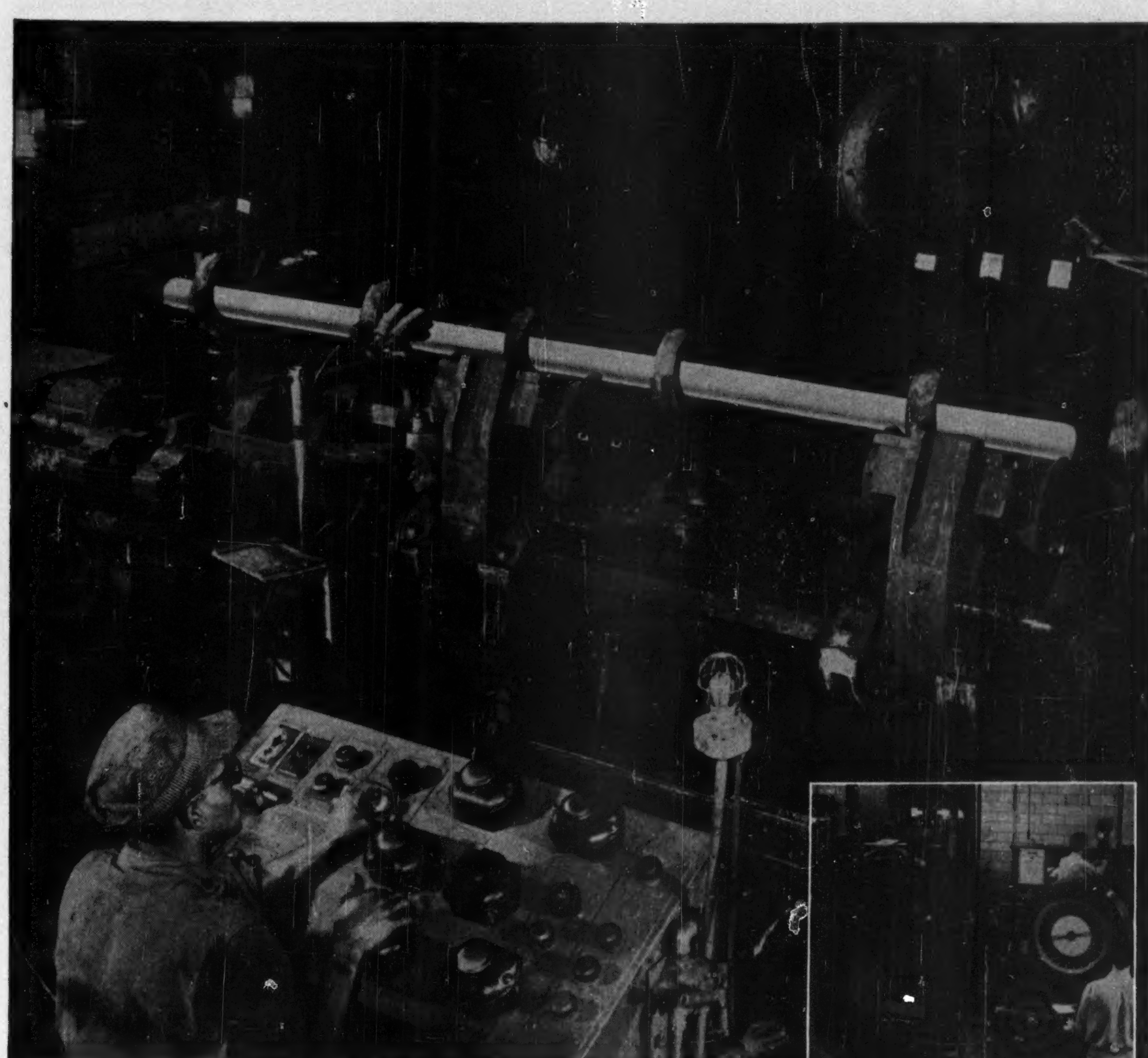
The Canadian Kellogg Company Ltd. has established complete shop facilities for the fabrication of all types of piping at EDMONTON, Alberta. Inquire directly or through any Kellogg or Canadian Kellogg office.

Fabricated Products Division, The M. W. Kellogg Company

New York, Jersey City, Los Angeles, Tulsa, Houston, Toronto, London, Paris

KELLOGG — SUBSIDIARY OF PULLMAN INCORPORATED

Specify GLOBE for the finest steel tubes



Globe's Physical Testing Laboratory — one of the seven different research and testing labs in Globe's House of Science.

Specialized research, engineering and production assure uniform high-quality STEEL TUBES

AT Globe, specialization is the keynote. Men, machines, and raw materials are all tailored to fit the Globe *specialized* process. Precision checks — and rechecks — at every stage of production insure Globe Tubes that meet *your* exacting specifications.

Be sure! Specify dependable, high-quality Globe Steel Tubes and be certain of getting the finest tubes available. Write for the General Catalog and become acquainted with Globe *specialized* process.

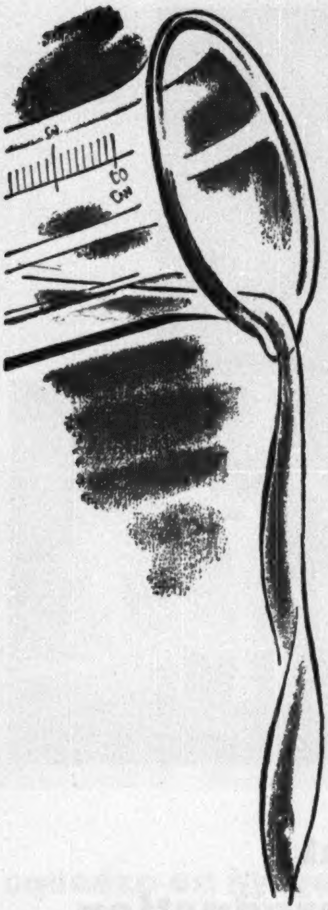
GLOBE STEEL TUBES ARE AVAILABLE IN:

• Stainless Steels — Globe seamless • High Purity Iron — Globeiron • Stainless Steels Gloweld Welded • Corrosion Resistant Steels • Alloy Steels • Carbon Steel • High-Temperature Service Steels • Standard and Special Analysis Steels • Mechanical and Pressure Tubing

GLOBE STEEL TUBES CO., Milwaukee 46, Wisconsin

Chicago • Cleveland • Detroit • New York • Houston • St. Louis
Denver • San Francisco • Glendale, Cal. • Philadelphia

GLOBE TUBES



PURE WATER

DISTILLED WATER OF LABORATORY QUALITY

- **for Pharmaceutical Needs**
- **for Chemical Processing**
- **for Potable Water Supply**

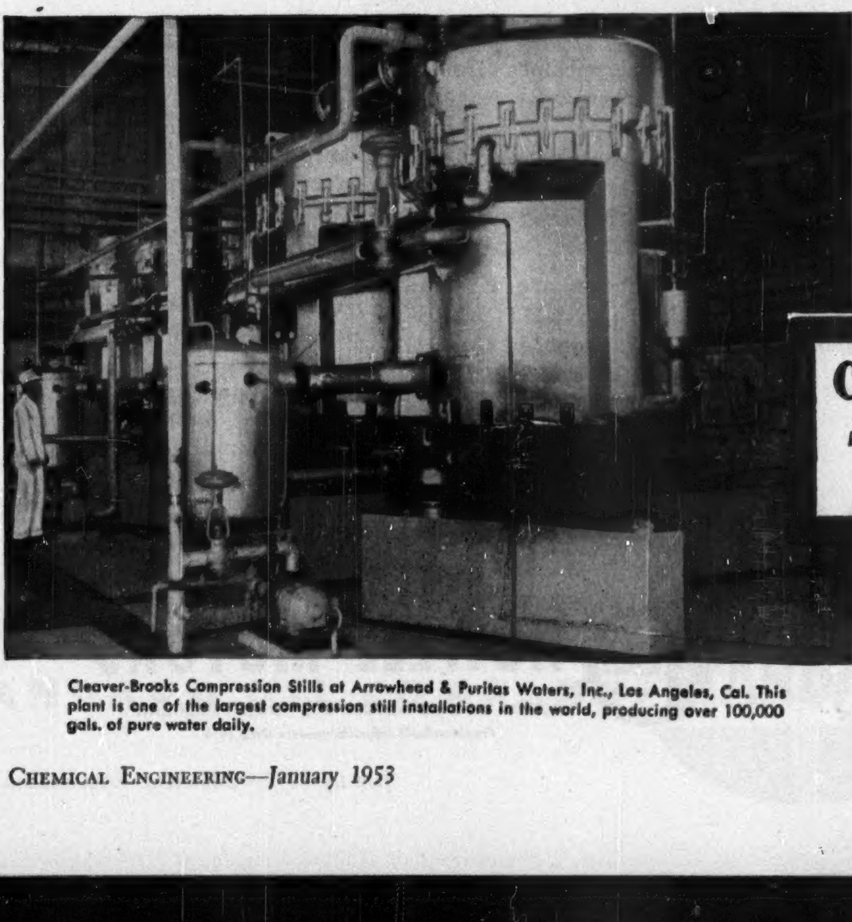
. . . At Lowest Cost with Cleaver-Brooks Compression Stills

WHEREVER water is needed — in quantity and quality — a Cleaver-Brooks Compression Still provides the most effective and the most economical method of water purification.

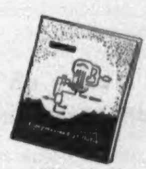
Potable water can be produced using a nearby source of brackish water or sea water, thus eliminating the need for pipe lines, trucking or barging facilities from a remote water source.

Where potable water is already available, but processing requirement demand chemically pure water, a Cleaver-Brooks Compression Still provides a USP chemically pure, pyrogen free water — far exceeding the high standards required for pharmaceutical preparations or chemical processing.

Cleaver-Brooks Compression Stills are available in standard size from 85 gph to 2800 gph motor, engine, or turbine driven.



Cleaver-Brooks Compression Stills at Arrowhead & Puritas Waters, Inc., Los Angeles, Cal. This plant is one of the largest compression still installations in the world, producing over 100,000 gals. of pure water daily.



Write for latest bulletin, "Compression Distillation," Cleaver-Brooks Company. Dept. K—364 E. Keefe Ave. Waukesha, Wis.

Cleaver-Brooks

Pioneers in the development of compression distillation

Builders of Equipment for the Generation and Utilization of Heat
Steam Boilers • Oil and Bitumen Tank-Car Heaters • Distillation Equipment • Oil and Gas-Fired Conversion Burners

(Above) Kreelon dryers with 5-H.P. Howell Motors at Wyandotte Chemicals Corp. (Right) 2-H.P. Howell explosion-proof motors drive tar pumps.

High demand for new detergent calls for uninterrupted production

Howell Motors on the job in Wyandotte's new Kreelon plant

The Wyandotte Chemicals Corporation's new synthetic detergent and wetting agent, Kreelon*, has become so widely accepted that steady production is absolutely essential to meet the demand.

Throughout the new Kreelon plant, special machines of many types are in operation constantly. And as is often the case in chemical plants, the production of these machines is kept on schedule by the dependable power of Howell Motors.

Shown above are Kreelon dryers driven by 5-H.P. totally-enclosed, fan-cooled Howell Motors. In the same plant, explosion-proof motors in various sizes drive kerylbenzene, tar and caustic pumps.

Many other manufacturers in the chemical and allied fields, too, prefer Howell Motors. They like Howell's superior design, precision construction and low maintenance. They like the way these motors stand up and deliver unfailing power under tough conditions.

If *your* motor operations demand this performance, ask the Howell representative in your city to give you the facts on standard and special motors. Sizes from 1/6 to 250 H.P.; types for every application. You'll get immediate help by calling today or by writing direct to the factory.

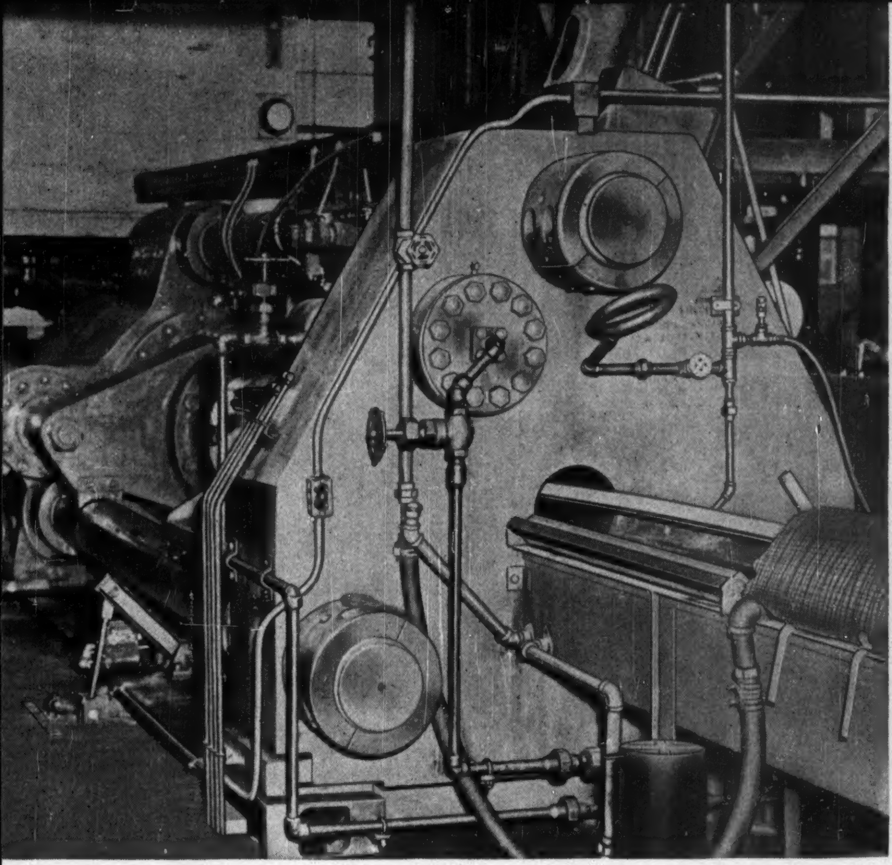
* Reg. U.S. Pat. Off., Wyandotte Chemicals Corp.

Howell explosion-proof motor for hazardous locations.

HOWELL MOTORS

HOWELL ELECTRIC MOTORS CO., HOWELL, MICHIGAN

Precision-built industrial motors since 1915



What's YOUR problem?

D. R. Clay, of Standard Oil's Grand Rapids, Michigan, office, is the lubrication specialist who has helped Light Metals Corporation keep maintenance of hydraulic units at a minimum through use of STANOIL Industrial Oil.

He is one of many Standard Oil specialists located throughout the Midwest. These men have the practical experience and special training to handle lubrication problems on any type of operation.

Take advantage of the service offered by the lubrication specialist nearest your plant. You can contact him easily by phoning your local Standard Oil Company (Indiana) office. With his help, find how many different oils in your plant can be replaced by STANOIL Industrial Oil on such applications as:

Air compressors . . . no sticking or clogging of valves, less oil consumption in splash or circulating systems.

Speed reducers . . . less wear of gears and bearings during frequent cold starts or prolonged high-temperature operation.

Steam turbines . . . freedom from emulsions and sludge, fewer oil changes necessary.

Ring-oiled bearings... rings function immediately on starting, less bearing wear.

Circulating and bath systems . . . one oil for a wide variety of jobs.

Puts squeeze on hydraulic press maintenance...

• Shown above is the 1250-ton hydraulic press used by the Light Metals Corporation of Grand Rapids, Michigan, for extruding variously shaped sections of aluminum. When this press was installed recently, officials gave the important hydraulic oil job to STANOIL Industrial Oil. They based that decision on their own experience with this outstanding oil.

That experience covered over four years' use of STANOIL in the hydraulic system of a 315-ton extrusion press. STANOIL has served continuously in this press without being changed or removed for oil maintenance. The hydraulic oil system has never been cleaned and has remained entirely free from deposits and varnish. Hydraulic operation has been efficient at all times.

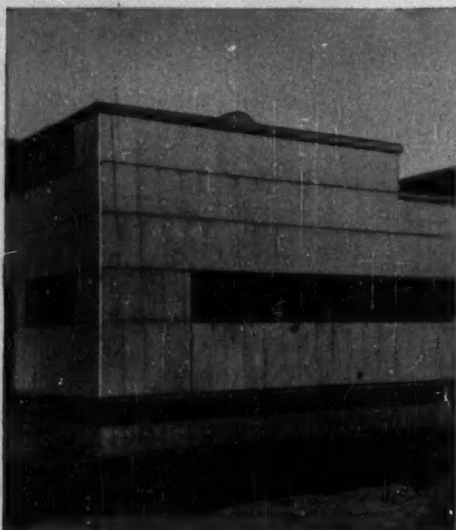
The experience of the Light Metals Corporation is your assurance of STANOIL's ability to reduce hydraulic system maintenance to a minimum in your plant. This versatile oil will provide clean, dependable lubrication for such a variety of equipment as air compressors, reduction gears, and electric motors. The Standard Oil lubrication specialists will help you make the most effective use of STANOIL. Phone him at your local Standard Oil (Indiana) office. Or write, Standard Oil Company, 910 S. Michigan Ave., Chicago 80, Ill.

STANOIL
TRADE MARK
Industrial Oil

STANDARD OIL COMPANY STANDARD (Indiana)

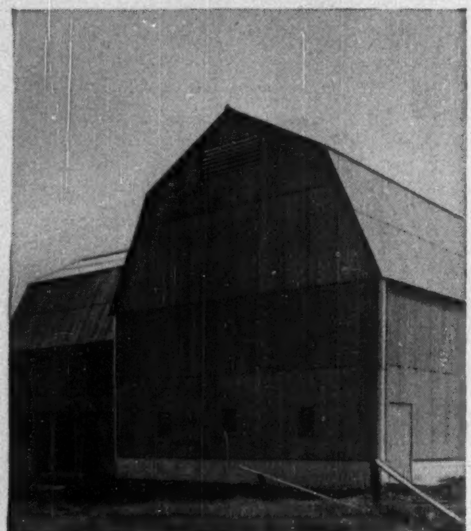
CORRUGATED *Asbestos* TRANSITE*

FOR THE FACTORY



Because it is practically indestructible, Johns-Manville Corrugated Transite is extensively used in this plant to provide a durable, trouble-free exterior.

FOR THE FARM



This large barn is typical of the excellent use of Johns-Manville Corrugated Transite on farms where it helps eliminate the threat of loss from fire, destructive rot, and vermin.

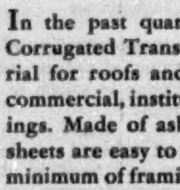
You build economically and quickly with these versatile fireproof and weatherproof asbestos building sheets

In the past quarter century, Johns-Manville Corrugated Transite has proven an ideal material for roofs and for sidewalls of industrial, commercial, institutional and agricultural buildings. Made of asbestos and cement, the large sheets are easy to handle, go up quickly with a minimum of framing. Practically indestructible, Corrugated Transite is fireproof, rotproof, weatherproof; needs no paint or special treatment to preserve it; and can be salvaged and re-used if necessary.

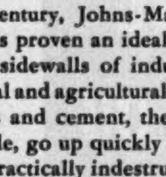
The streamlined corrugations and attractive shadow lines of J-M Corrugated Transite have great architectural appeal . . . creating a contemporary effect in keeping with today's growing requirements for functional beauty inside as well as out.

Investigate J-M Corrugated Asbestos Transite and learn how you can build quickly and easily . . . have an attractive, long-lasting, trouble-free structure regardless of size or purpose. For complete details write Johns-Manville, Box 158, Dept. CE, New York 16, N.Y. In Canada write 199 Bay Street, Toronto, Ontario.

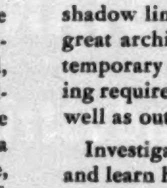
*Reg. U.S. Pat. Off.



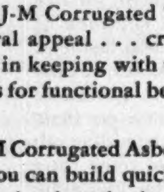
EASY TO FASTEN TO STEEL



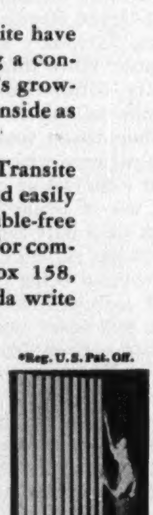
EASY TO SAW



EASY TO DRILL



EASY TO NAIL TO WOOD

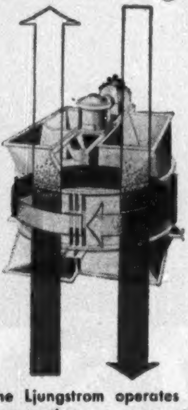


JM

Johns-Manville *Asbestos* CORRUGATED TRANSITE

GUIDEPOST TO ECONOMY...

The Ljungstrom Air Preheater



The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves, the heat is transferred from the waste gases to the incoming cold air.

Every year, the process industries consume hundreds of millions of barrels of fuel. Refineries alone, for example, use up more than 200,000,000 barrels annually for processing crudes. This vast quantity of fuel represents probably the *greatest single item* in operating expense. If lower costs are to be realized, serious thought must be given to heat-conservation equipment.

The Ljungstrom Air Preheater offers the process industries a chance to save as much as *20% of the fuel needed for process work.* This fuel saving, plus the added benefit of increased production, makes the Ljungstrom an eminently practical piece of equipment to be considered wherever fuel is burned.

Check today to see how the Ljungstrom Air Preheater will pay for itself in just a few months – and give you impressive savings for years to come. Call or write The Air Preheater Corporation for full details.

Wherever You Burn Fuel, You Need Ljungstrom

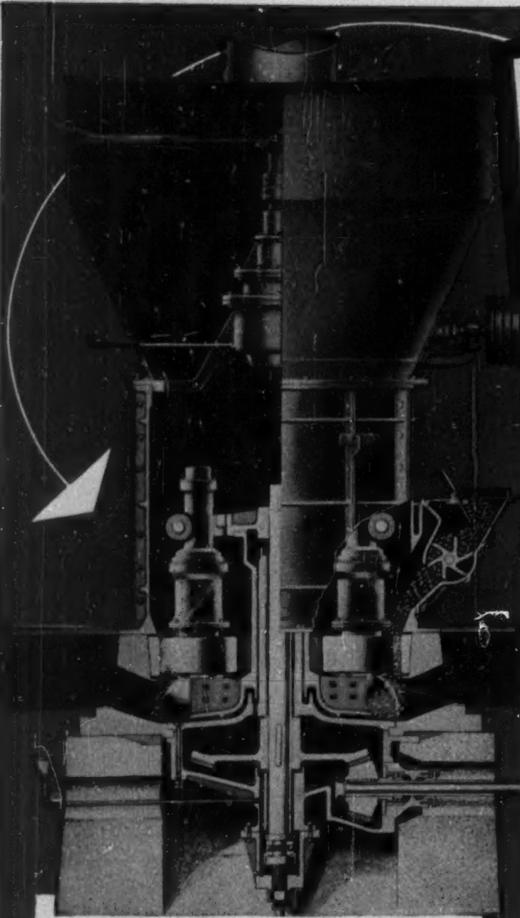
THE AIR PREHEATER CORPORATION

60 East 42nd Street, New York 17, N. Y.

Increase Your Output Of FINE GRINDING

...with greater uniformity ...at lower cost

WILLIAMS *Roller Mills*



Cross section of Roller Mill showing how material is ground by rolls rotating against bull ring, then air swept to separator which extracts fines and returns coarse material to mill for regrinding.

Insecticide formulas, pigments and dry colors, barytes, phosphate, limestone—whatever the material, if it has to be finely ground, there's a Williams Roller Mill to do it—faster, for stepped up production—more accurately and uniformly—and at far less cost!

Automatic and continuous in operation, the Williams also dries and grinds simultaneously. Instantly adjustable for finenesses of 20 to 400 mesh, even down to micron sizes. No built-up cushions of "fines" can impair grinding efficiency because the constant upward air current carries ground materials to the air separator which discharges *all* finished materials and returns *only* the oversize product to the mill for further grinding.

Feeding rate is automatic and self-adjusting, positive and simple in action—Anti-friction roller and ball bearings reduce down-time for lubrication, save oil and put more power into grinding—Take-up for wear is continuous and automatic—Rugged forgings, electric steel and alloy castings guard against wear and breakdowns—These and many other outstanding features have made Williams Roller Mills the standard for fine-grinding operations.

Write For Catalog

OTHER WILLIAMS EQUIPMENT

HAMMER MILLS

Heavy duty construction in many sizes for crushing and grinding to small size, in one operation, phosphate, gypsum, limestone, shale, bauxite, asbestos rock and virtually all other chemical and fibrous materials.

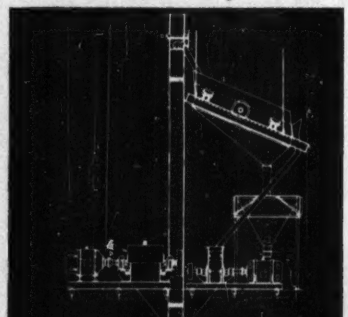
HELIX-SEAL HAMMER MILLS

Dust-free fine grinding, 100 to 325 mesh, without fans, cyclones or air separators. Variable speed feed control. Will also handle wet, sticky, oily and greasy materials without clogging. Easy to install; inexpensive to operate.

IMPACT and DRIER MILLS
AIR SEPARATORS
VIBRATING SCREENS

WILLIAMS COMPLETE PLANTS

Backed by years of know-how and experience, Williams can build any type of ready-to-install plant to handle crushing, grinding, air separation, sifting, conveying and magnetic separation including storage bins and electrical equipment.



WILLIAMS PATENT CRUSHER & PULVERIZER CO.
2706 N. 9th ST. ☆ ST. LOUIS 6, MO.

WILLIAMS

CRUSHERS GRINDERS SHREDDERS

OLDEST AND LARGEST MANUFACTURER OF HAMMER MILLS IN THE WORLD

It pays to keep an eye  on VICTOR CHEMICALS

(Scanning time: 1 min. 45 sec.)

VICTOR ACIDS . . . VERSATILE CHEMICALS MAY OFFER POSSIBILITIES TO YOU

To the chemist, phosphoric acid, formic acid, and oxalic acid are as common as the test tube, yet their unique properties inspire new uses constantly. Present uses of these versatile Victor acids are almost endless, as are the many different advantages they provide. Consider once again their properties described on the following page. In them you may see an opportunity of application and the solution to an important product or process problem. Victor's technical and research staff will willingly help you explore that possibility. Experimental samples of these Victor acids are available. Mail the coupon.

NEW VICTOR ACIDS MAY BE CHEMICALS YOU SEEK

The new Victor Acids described on the next page are offered for your evaluation. The unusual properties of Victor Carbamide Phosphoric Acid, Borophosphoric Acid, and Formic Acid, Anhydrous, indicate usefulness in many applications. These new Victor chemicals may be what you've been looking for and could be the key to a worthwhile development for your company. Mail the coupon for experimental samples.

VICTOR . . . *THE* DEPENDABLE SOURCE OF SUPPLY

Users of phosphates, phosphorus compounds, formates and oxalates gain a big advantage by choosing Victor as a source of supply. Victor is known as . . . *the* dependable name in chemicals. This is especially true of Victor service.

If the regular delivery of chemicals is essential to your production, consider this: Victor is the only producer in the industry with 3 elemental phosphorus plants and 4 processing plants to serve you. Victor's multiple sources of power, labor, raw materials, and transportation insure dependability of supply for you. Then, too, Victor's plants are strategically located from coast to coast to serve you better and offer even greater security of supply.

Remember Victor's multiple plant facilities and nationwide service when selecting your source of supply. Remember Victor . . . *the* dependable name in chemicals.

BRING YOUR PRODUCT PROBLEM TO VICTOR

Victor has specialized in the development and manufacture of phosphates and phosphorus compounds for 54 years. You can benefit from this experience and the knowledge gained. If you have a product or process problem, bring it to Victor. Our technical and research staff will be pleased to work with you.

NEW FOLDER ON VICTOR RESEARCH CHEMICALS AVAILABLE

A new folder which describes 45 Victor research chemicals is available. Technical information and suggested uses are given. Mail the coupon now for your copy.

VICTOR CHEMICAL WORKS
141 West Jackson Boulevard, Chicago 4, Illinois
Please send without cost or obligation:

- ☐ Sample of Phosphoric Acid
- ☐ Sample of Formic Acid
- ☐ Sample of Carbamide Phosphoric Acid
- ☐ Sample of Formic Acid Anhydrous
- ☐ Sample of Borophosphoric Acid
- ☐ Sample of Oxalic Acid
- ☐ Copy of New Research Folder

NAME__________ TITLE__________

COMPANY__________

STREET__________

CITY__________ ZONE____ STATE______

(Fill in and attach to company letterhead)

IMPORTANT PROPERTIES OF VICTOR ACIDS

PHOSPHORIC ACID

H_3PO_4

Phosphoric acid is a clear, colorless, sparkling liquid. All grades meet the requirements of the Federal and State Pure Food Laws.

Concentrations: 75%
80%
85% N.F.

USES: Manufacture of yeast, sugar, soft drinks, imitation jellies, gelatin, pharmaceuticals; rustproofing, engraving, railroad car cleaning, refining oil and gasoline, preserving silage; weighting silk, dyeing textiles; chemical polishing and electro-polishing metals, bright-dip baths for aluminum; manufacture of phosphates, dental cements, glue, ceramics, glass, metal treating compounds, explosives, fertilizers.

CARBAMIDE PHOSPHORIC ACID

$CO(NH_2)_2 \cdot H_3PO_4$

White rhombic crystals. Mol. Wt. 158. Very soluble in water and alcohol. In solution it is essentially carbamide and phosphoric acid, and is therefore a convenient solid form of phosphoric acid.

USES: An efficient catalyst for acid setting resins. It is recommended where a solid form of phosphoric acid is desired, and is useful in flameproofing compositions, in cleaning compounds, and as a general acidulant.

BOROPHOSPHORIC ACID

$BPO_4 \cdot H_2O$

Melting point, decomposes. Density, 1.873. A white, water soluble, crystalline, nonhygroscopic solid. Ignition loss, 18.5%. pH of 1% solution, 2.0. Total acidity when dissolved in water is equal to 79%, calculated as orthophosphoric acid. This also includes acidity due to the presence of the boric acid.

USES: This compound is recommended where a solid non-hygroscopic acid is desired. Not recommended for food applications. Availability: Semi-commercial quantities.

FORMIC ACID

HCOOH

Formic acid is a fuming, colorless, corrosive liquid that evaporates completely on exposure to the air. It has a characteristic pungent, penetrating odor, and is milder than muriatic or sulphuric acid; considerably more active than acetic acid. pH of 1% solution approximately 2.15. Concentrations: 85% and 90%.

USES: Tanning, acidifying dye-baths, souring in laundries, plating baths; manufacturing formates, fumigants, insecticides, pharmaceuticals, antibiotics, refrigerants, solvents for perfumes, lacquer; wire stripping compounds.

FORMIC ACID—ANHYDROUS

HCOOH

Mol. Wt. 46. A clear, water-white, volatile, hygroscopic liquid. Freezing point 8.4°C. Boiling point 100.75°C. at 760 mm. Specific gravity 20/4°C., 1.2196. Refractive Index n_D^{20} 1.3714.

USES: Special purpose solvent, catalyst in organic synthesis. Availability: Research samples and experimental lots by arrangement. Caution—Harmful to skin and other tissues.

OXALIC ACID

$(COOH)_2 \cdot 2H_2O$

Oxalic acid is a brilliant, transparent, colorless, crystalline material.

Typical quality: Assay (min.) 99.8% $(COOH)_2 \cdot 2H_2O$
SO_3 (max.) 0.05%

Solubility: 12.5 parts in 100 parts of water at 25°C. Oxalic acid, anhydrous, is also available on special order. This material is a chalky white solid, soluble in water.

Typical analysis: $(COOH)_2$ 99.25%

USES: Radiator cleaning compounds, leather processing, bleaching of straw, wood, cotton linters; laundry sour for discharging bleach and removing iron stains; washing coal; removing rust stains from marble; manufacture of metal polishes, blueprints, dyes, bluing; purifying compound and precipitating agent; analytical reagent; reclaiming colored candles; ink and rust remover; purifying rosin; cleaning railroad cars.

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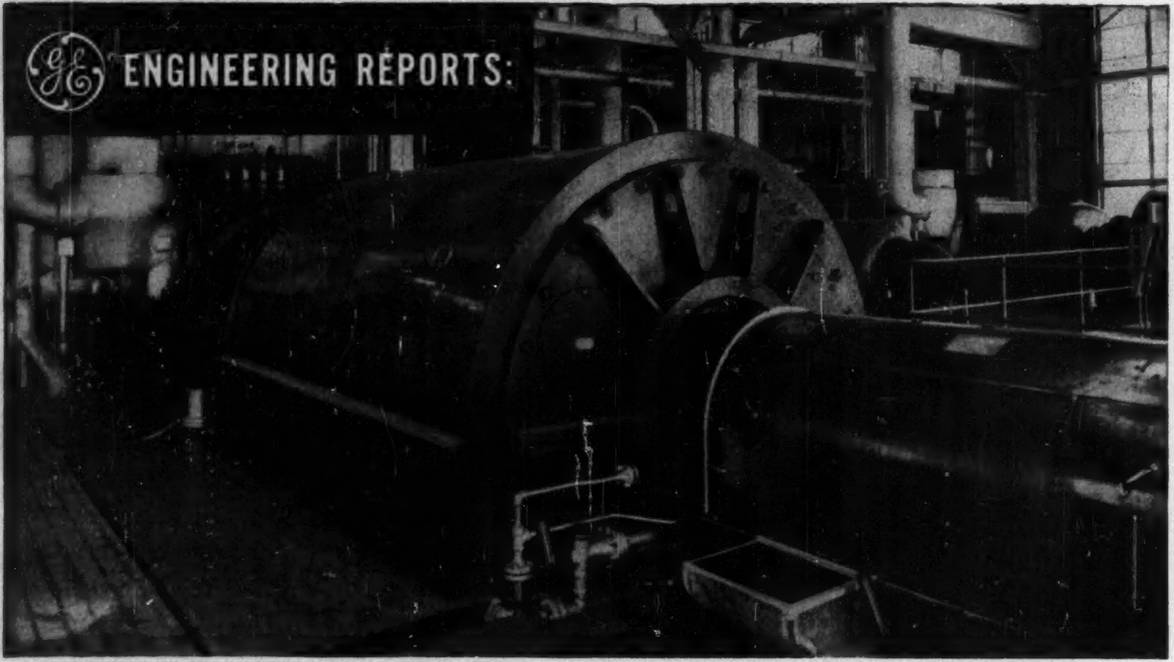
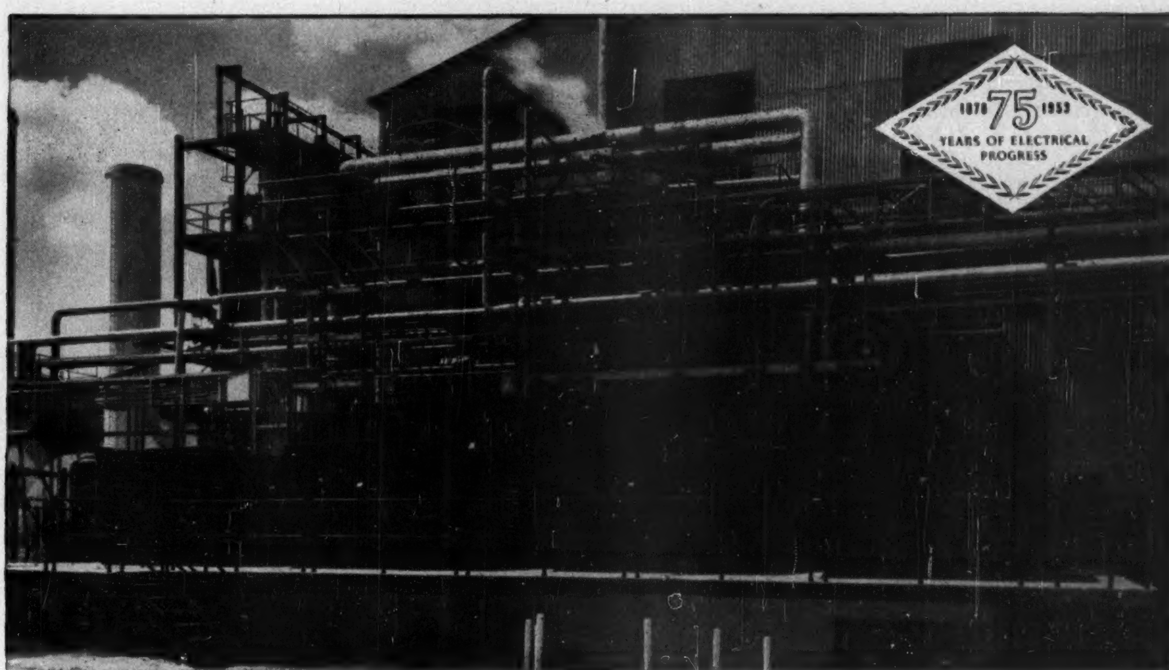


POWER for Diamond Alkali's Gulf Coast chlorine plant is produced economically as a by-product of process steam by three G-E 10,000-kw turbine-generators (one shown). Long, reliable service distinguishes G-E turbines in chemical industry-

Engineered power system is key

COMPLETE RECTIFIER SYSTEM supplied and co-ordinated by General Electric includes (left to right) cathode breakers, excitation cubicles, rectifier tanks, and anode breakers. The 12 rectifiers shown each contain 12 ignitron tanks.



CONTINUITY OF SERVICE is increased by a synchronizing-bus system and secondary selective arrangement to provide low-voltage power. These 4 G-E 13.8-kv switchgear units are grouped outside the turbine building to shorten cable runs.

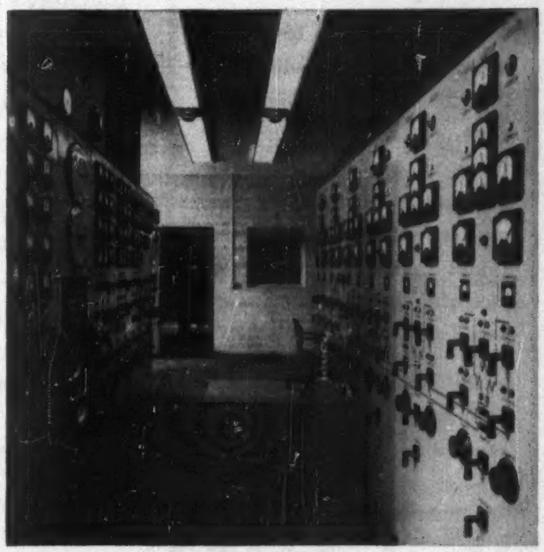
to chlorine plant's high output

Diamond Alkali installs engineered system to help maintain 920-ton daily output

In its Gulf Coast plant near Houston, Texas, Diamond Alkali produces 920 tons per day of caustic soda and liquid chlorine. Because of the large amounts of process steam required—which can also be used to generate power as a by-product—they made use of the help offered by G-E application engineers in applying the equipment needed for an addition to their power system.

Result: G-E turbine-generators develop low cost plant power as a by-product of needed process steam. Additional power is purchased from the local electric utility. G-E metal-clad switchgear units and synchronizing bus system assure power continuity for essential loads. G-E control equipment for power house and rectifier room is grouped together to save manpower and to provide centralized control. A complete G-E rectifier system provides continuous d-c power for cell lines.

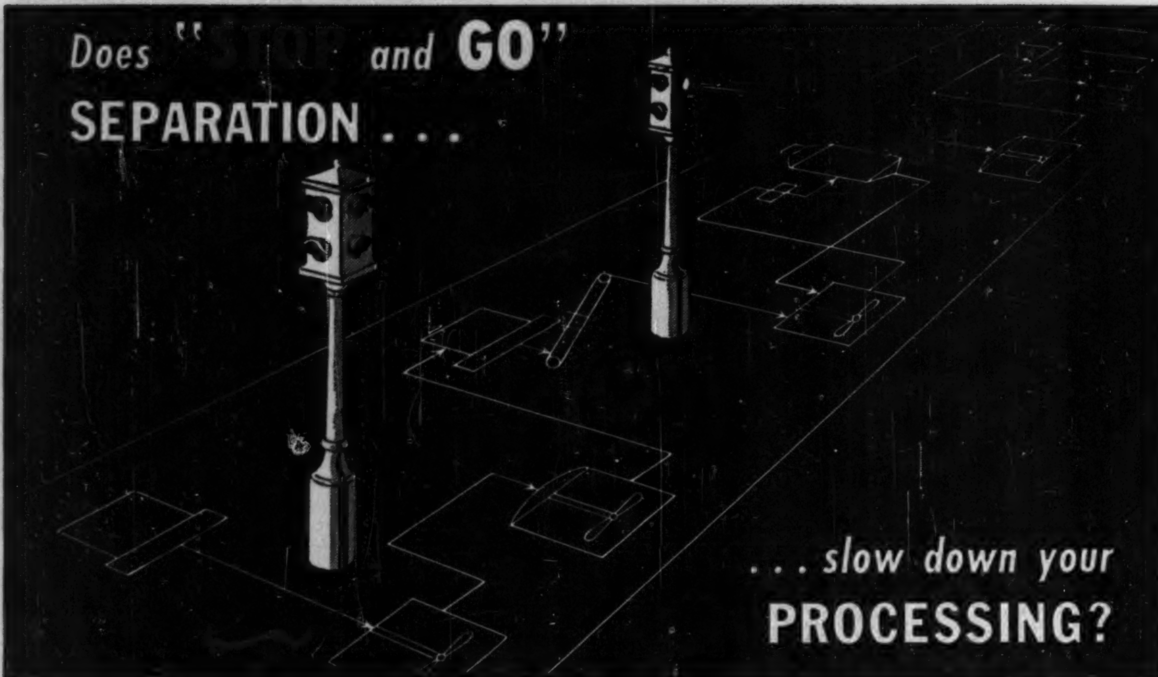
Whatever your chemical plant's power-system needs, an experienced G-E application engineer can help you meet them efficiently, economically. For more information, contact your nearest G-E Apparatus Sales Office. General Electric Co., Schenectady 5, N. Y. 662-40



CENTRALIZED CONTROL of both the turbine-generator (left) and of the rectifiers (right) in one location enables one set of operators to supervise the plant's entire power system.

Engineered Electrical Systems for Chemical Plants

GENERAL ELECTRIC



Why Buy DE LAVAL?

For 70 years, De Laval has never compromised with quality. De Laval machines are built to apply centrifugal force to the solution of a problem *in the most efficient manner.* Many De Laval machines remain in useful service after 20, 25 or even more years.

De Laval quality pays—both in long life and in better separation.

The flow of a chemical or food process must be continuous if it is to be profitable. De Laval centrifugal machines speed up a process by removing the bottlenecks that inferior methods of separation or clarification can cause. These machines take lost motion out of (1) liquid-liquid (2) liquid-solid or liquid-solid-and-liquid separations by making each ***continuous*** by means of centrifugal force.

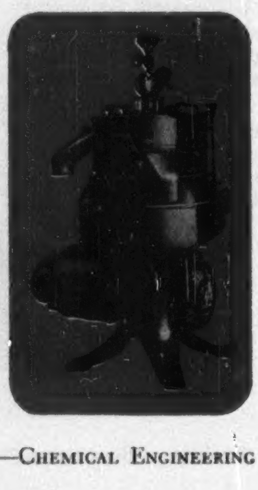
Sometimes De Laval centrifuges will reduce a separation process that once took minutes to a few seconds. Moreover, in making a separation continuously, these machines frequently make a ***cleaner*** separation than could be effected by stop-and-go methods.

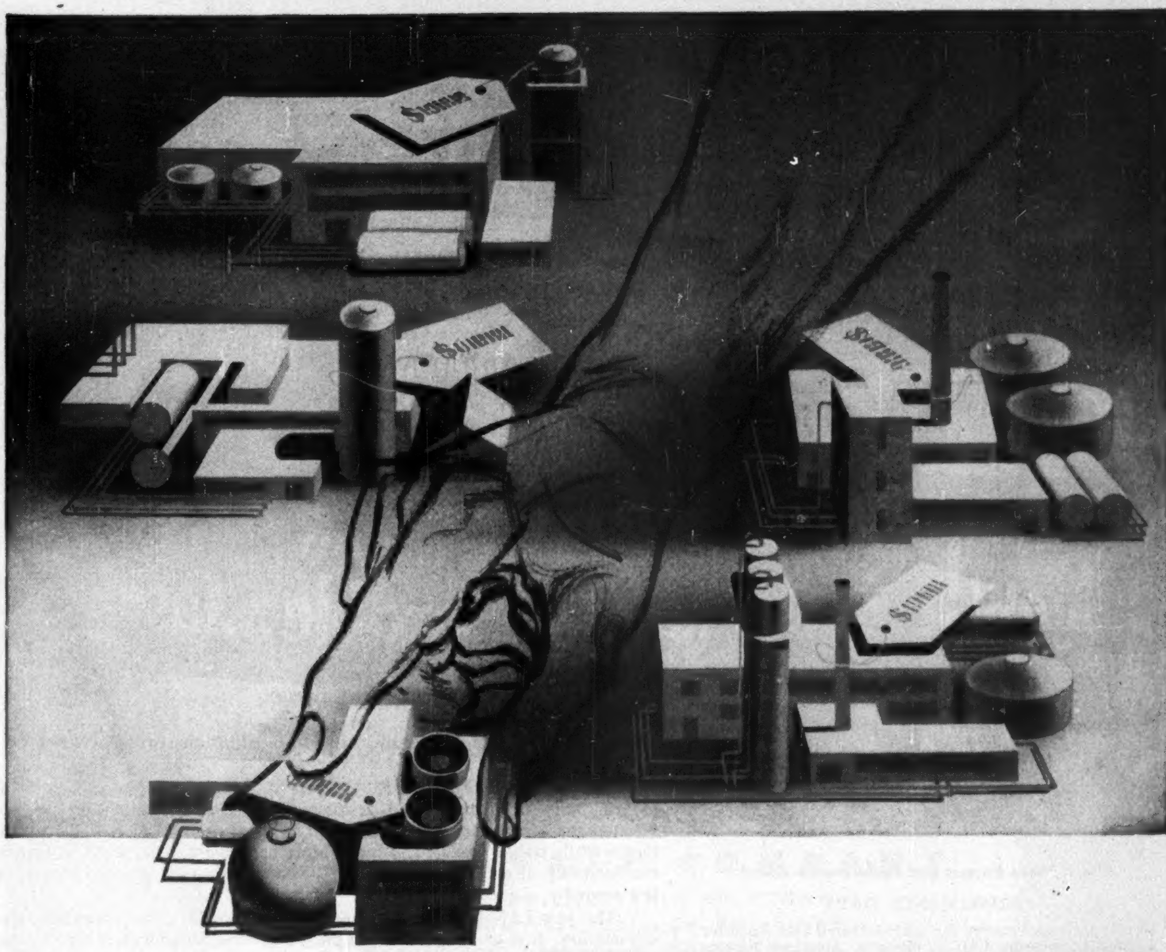
De Laval centrifugals come in many different types and sizes to enable each application for centrifugal force to be met exactly. In writing for information, outline your general problem to De Laval engineers.

THE DE LAVAL SEPARATOR COMPANY
Poughkeepsie, New York   427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

DE LAVAL

MAKES SEPARATION AND CLARIFICATION
CONTINUOUS





TYGON

Versus $C_{17}H_{33}COOH$

OLEIC acid and the other fatty acids have many uses. By the same token, they also can represent many problems in the fight against corrosion. Particularly at high temperatures, under aeration, or in combination with other chemicals do they prove troublesome.

There are a number of materials which offer protection against oleic acid. Among them is the TYGON family of plastic compounds. However, the satisfactory use of TYGON compounds against oleic acid depends upon their proper use — upon the realization of the limitations of organic resins and plasticizers in contact with organic acids.

The TYGON family consists of a number of standard and special compounds based on a series of selected vinyl resins which are skillfully modified with other materials to give the maximum in resistance to acids, alkalies, oils, greases, water and most solvents. They are also designed to give the best balance of chemical resistance with desirable physical, mechanical and electrical properties. For further versatility, TYGON is made available in the forms of calendered or press-polished sheeting, molded goods, extrusions, paints and plastisols.

Against the oleic acid, the resistance and performance of TYGON, in any of its forms, depends primarily upon the concentration of the acid and the service temperatures involved. At low acid concentrations and low temperatures, the resistance and performance of TYGON are excellent. However, as concentration or temperature increase, definite changes take place. If both are increased, the apparent limits are full concentration at 125°F. Beyond this point, the protectability of TYGON is relatively unaffected, but physical changes limit its performance. Pronounced hardening and stiffening gradually take place, along with a noticeable color change. Thus, at high temperatures, the efficiency of TYGON is reduced with time and concentration.

Where mixtures of oleic acid and other chemicals are encountered, the resistance of TYGON varies according to the nature of the other chemicals present. It is difficult to estimate the degree of protection offered, without full knowledge of the existent conditions. Previous testing or the counsel of U. S. Stoneware engineers is strongly recommended.

In general, TYGON safely handles oleic acid at the concentrations and temperatures normally encountered in its use. Only the extreme cases require special consideration. In addition, the variety of compounds and the different forms available give TYGON wide application.

As calendered or press-polished sheeting, TYGON is used to line and cover all types of process equipment. It also is die-cut in positive and enduring gaskets, seals, and separators.

As molded goods, TYGON is also used for gasketing, but has many other uses which are limited only by the size and shape that can be imparted to a thermoplastic material by mold and press.

As extruded tubing (in sizes up to 2" ID), TYGON finds many uses in both plant and laboratory. Its clarity, flexibility, light weight, and high strength greatly speed and simplify the transmission of corrosive liquids, gases and semi-solids. Extruded solid cord and channel are also used as gasketing, expansion jointing, and packing.

As a paint, TYGON protects equipment and plant against corrosive fumes and spillage. As a plastisol, TYGON is used as a heavier duty coating or in the manufacture of flexible parts and fittings.

If you have fatty acid, or any chemical, corrosion problems, look into TYGON. It may well be the sure, simple, economical answer.

In addition to TYGON in its various forms, we also manufacture a number of other materials capable of handling oleic acid and other fatty acids in any concentration and under all types of operating conditions. These products include chemical stoneware and porcelain, acid proof brick and cements, homogenous lead linings, and other organic linings and coatings.

Why don't you submit your corrosion problem today? There's no obligation and we'll be pleased to be of assistance. So write, now!

63D

THE UNITED STATES STONEWARE CO., Akron 9, Ohio

ENGINEERS, MANUFACTURERS, ERECTORS OF CORROSION-RESISTANT EQUIPMENT SINCE 1865

THE *Chementator*®

Prepared under the direction of Joseph A. O'Connor, News Editor

• Watch for a new process for desulphurizing crude oil. Wigton Abbott Corp. of Plainfield, N. J., is winding up pilot-plant work before taking the wraps off this new process.

• Carboxymethylcellulose is now produced in the Memphis, Tenn., plant of Buckeye Cotton Oil, a P&G affiliate, by a continuous process. Hydrolyzed cellulose sheet is etherified by chloracetic acid with causticization before and after.

New separation process for potash ore

A new and revolutionary beneficiation process for potash, phosphate and other ores has been developed by International Minerals & Chemical Corp. More economical than other present methods, the new LeBaron-Lawver process uses neither reagents nor water. Instead, it is a dry beneficiation method.

The new method of refining ore was developed under the direction of Dr. Paul D. V. Manning, International's vice president in charge of research. The process bears the names of Dr. I. M. LeBaron, director of International's research laboratories, and James E. Lawver of the research staff.

In the LeBaron-Lawver dry beneficiation process the ore is ground, dried and given a simple and inexpensive treatment, after which the ground ore is passed between electrodes. As the treated ore passes between the electrodes it separates into various minerals.

While International keeps coyly mum about how the process works, experts speculate on the possibilities. The treatment might consist of coating the surface of certain mineral particles to change the conductivity. Adding a dry powder and then heating, for example, might convert the powder to an oxidized layer on the surface of the particles. This could be followed by a high-intensity electromagnetic separation. Or the process may be an electrostatic separation. The electromagnetic or electrostatic field would deflect certain particles sufficiently to separate them from the rest of the ore—most likely the gangue.

Whatever the process, it will have to work selectively on the potash minerals sylvinite and langbeinite to remove sodium chloride and possibly anhydrite, gypsum, limestone and red shale. It would have to work similarly with the apatite of phosphate rock. International won't say on what other minerals the new method can be used.

So far, International has spent about $1 million to develop its new beneficiation process. Potash ore from Carlsbad, N. M., has been treated by the process in IM&C's pilot plant at Mulberry, Fla. A new and larger pilot plant will be built at the present Carlsbad refinery to operate continuously, treating semi-commercial quantities of potash by the new method. International also plans another shaft and mine on its ore body in the Carlsbad basin. This will probably cost close to $5 million. And International has just about completed designs for the construction of the first large potash plant in the Carlsbad area to use the new dry beneficiation process.

British to produce titanium

Imperial Chemical Industries will build pilot plants for production of wrought titanium and its alloys. The decision comes after three years of research and development on the manufacture of titanium.

When the new pilot plants are in production, they will provide a British source of titanium for the development of new uses in engineering and in aircraft.

Chemical industry shifts south and west

The record expansion, costing close to $6 billion, currently taking place in the nation's chemical industry is rapidly moving the center of this fast-growing industry southward and westward, according to the MCA.

While all parts of the country have shared in the tremendous growth of the industry over the past two years, most of the new chemical plants have gone up in the South, especially along the Gulf Coast, and in the Middle West.

The industry, according to MCA Chairman William H. Ward, is approaching the halfway mark in its expansion program costing close to $6 billion for the five years 1951-1955. This will mean roughly a one-third increase in the size of the 1950 chemical industry. It tops off a World War II expansion estimated at $3.5 billion and a postwar expansion of about $5 billion. The current program will add more than 200,000 employees to the payrolls of the chemical industry.

Plastics, synthetic fibers, detergents and agricultural and medicinal chemicals will account for much of

(Continued on page 102)

the growth, Ward predicts. Among basic industrial chemicals, there will be substantially increased output of chlorine, alkalis and ammonia.

"The expansion is among the largest ever undertaken by a manufacturing industry," Ward says. "As such it has raised some major financing problems, necessitating sale of a record amount of new chemical company securities in addition to use of depreciation reserves and profits." Declining chemical industry profits caused by rising taxes and other costs since 1950 have complicated the problem, according to Ward.

Less than 70 percent of the total expansion for the industry is covered by certificates of necessity. Up to mid-October of last year DPA had issued 789 fast tax writeoffs on chemical and allied projects. There are many other expansion projects in the chemical industry for which no rapid amortization has been granted.

Although certificates have been issued for chemical projects in 45 out of the 48 states plus Hawaii and Alaska, the greatest expansion has come in the west south central region comprising Texas, Louisiana, Oklahoma and Arkansas. This area has a total of $706,344,000 in new plants covered by certificates. This is almost twice the next largest total of $372,888,000 for the east north central states of Ohio, Indiana, Illinois, Michigan and Wisconsin.

Thus there is a major trend southward and westward from the Middle Atlantic states, traditionally the leading chemical producing area of the country. The Middle Atlantic region ranks fourth in the current expansion with a total of $296,605,782 in new plants.

The breakdown for other regions shows: south Atlantic, $298,070,968; east south central, $198,512,000; Pacific, $136,532,000; west north central, $102,856,000; mountain, $73,986,332; and New England, $31,313,000.

Texas leads all states in the nation with projects totaling $435,088,000. Louisiana is second with $202,859,000, and Michigan third with $150,760,000.

Big reason for the concentration of new chemical activity in the Southwest has been the combination of abundant raw materials, particularly petroleum and natural gas, plus low-cost water transportation to eastern markets. Most of the expansion in the area has been in ammonia and in plastics and synthetic fibers, all from petroleum or natural gas.

Much of the middle western expansion has likewise been in petrochemicals, partly based on local gas fields and partly on gas piped in from the Southwest.

Largest single certificate for a chemical project went to Chemstrand for an $88 million nylon plant at Pensacola, Fla. Other whopping projects: a $66 million ethylene oxide and polyethylene plant at Seadrift, Tex., being built by Carbide & Carbon; another $36 million polyethylene plant for Carbide at Torrance, Calif., first on the West Coast; a $44 million plant at Houston, Tex., in which Ethyl Corp. will produce tetraethyl lead; and a $30 million ammonia plant for Lion Oil at New Orleans.

Impulse rendering: fats out in the cold

A new process for removing fats and oils from cellular materials employs the principle of impulse rendering. Developed in England by I. H. Chayen of British Glues & Chemicals Ltd., it will be offered in the United States by Sharples Corp. Unlike present extraction processes, the Chayen continuous cold degreasing process requires no heat. And it's much faster.

Three plants of British Glues & Chemicals in England are now using the process. In Canada, the Toronto plant of W. Harris Ltd., also a glue maker, can handle 5,000 lb. per hr. of bone, removing the fat by the Chayen process.

Here's how the new cold rendering method works: a suspension of 1 part bone in 7 parts of water goes into the impulse renderer; a high-speed rotating element sets up impulses of from 45,000 to 50,000 beats per minute in the water; these impulses or shock waves, acting hydraulically, tear open the cells and wash out the fat; the cells fill with water so they cannot again take up fat. Degreased bone is ready for glue making within 8 min. after the start of operations.

Defatted bone can be used for fertilizer, animal feed or glue. The fat produced is high-grade tallow for soap making or other uses.

Nor is the process limited to degreasing bone. It can be used on cellular materials of animal or vegetable origin, and may become competitive with extraction processes for getting vegetable oils from oilseeds and fish oils from fish livers. It might be used, for example, to get coconut oil or cottonseed oil.

Sharples is licensed to sell, engineer and install the process in the United States. Sharples is now operating a pilot plant in Philadelphia that can handle 1,500 lb. per hr. of bone and more of soft fats. In this pilot plant, other possible uses of the Chayen process are being explored.

Only novel equipment in the process is the impulse renderer itself. Other equipment is conventional, principally centrifuges and screw conveyors. High-speed centrifuges are used for final dewatering.

New plant to make maleic and fumaric

Maleic anhydride and fumaric acid will be produced by the catalytic oxidation of benzene in a new $4.5 million plant that Allied's National Aniline Division is building near Moundsville, W. Va. DPA has granted a fast tax writeoff on 50 percent of the cost of the plant, which should be running late this year or early in 1954. A new aniline plant is also being constructed at Moundsville.

National Aniline's maleic anhydride capacity will be substantially increased by the new plant. Maleic is used by the makers of synthetic resins and plastics in

(*Continued on page 106*)

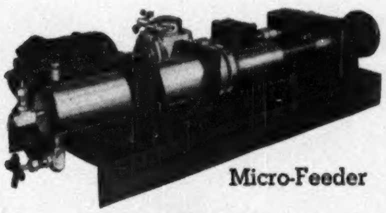
CHEMICAL PROPORTIONING PUMPS

for Every Process Plant!

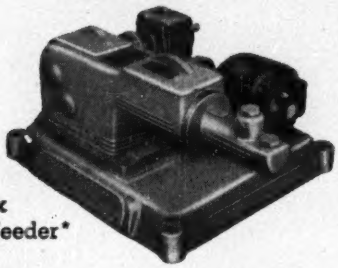
FROM PILOT PLANT OR LABORATORY USE TO THE LARGEST INSTALLATION . . . . .

PLUNGER TYPE PUMPS

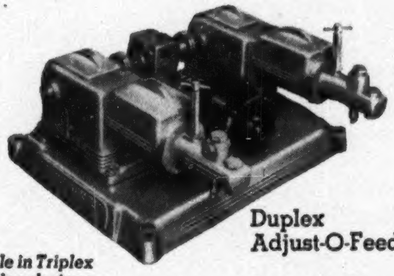
FOR HIGH PRESSURES



Micro-Feeder



Simplex Adjust-O-Feeder*



Duplex Adjust-O-Feeder

**Also available in Triplex and Quadruplex designs*

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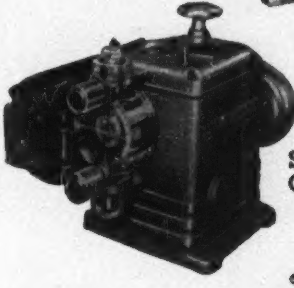
FOR UNIVERSAL APPLICATION AT LOW PRESSURES

Micro-Shot



Simplex Chem-O-Feeder*

Duplex Chem-O-Feeder

**Also available in Triplex*

COMPLETE FLEXIBILITY OF APPLICATION

%Proportioneers, Inc.% can supply proportioning pumps, with control panels, chemical tanks, dissolvers, and all other units required — a single responsibility for your complete chemical feeding system. Consult us regarding the layout and installation of chemical proportioning equipment for automatically treating, blending, diluting and sampling in process operations.

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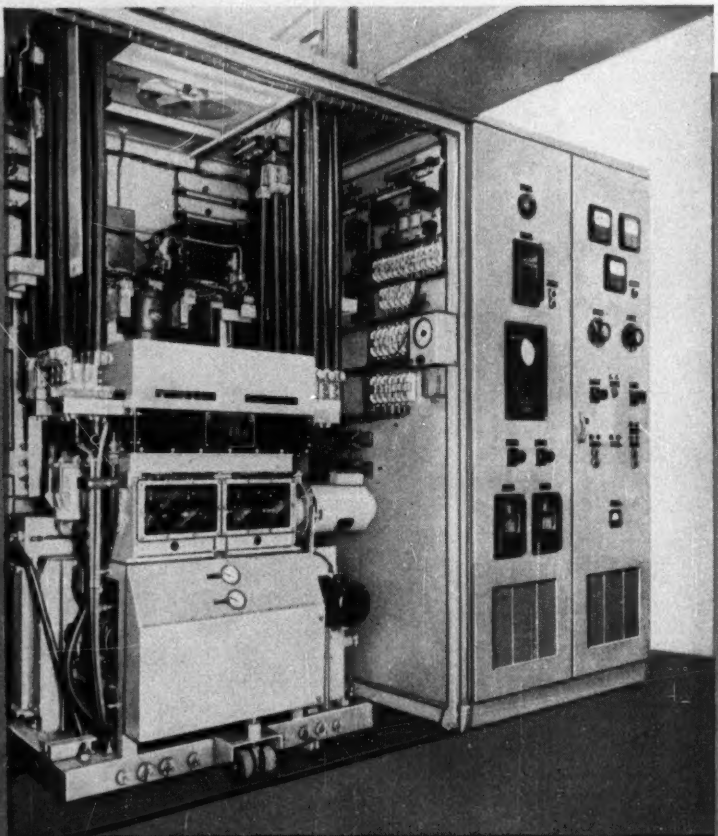
Technical service representatives in principal cities of the United States, Canada, Mexico and other foreign countries.

d-c power in 2 minutes with an



Practically instantaneous starting is one of the many advantages you get by using the I-T-E Mechanical Rectifier. This source of low-cost d-c power in the 50 to 400 volt range can be on the line, operating at full load, within 2 minutes of the time the starting button is pushed. Even less time is required if the rectifier is not used in parallel with other types of d-c sources.

There are only 5 quick steps to starting—4 to stopping the equipment. These are easily performed by unskilled labor.

I-T-E Mechanical Rectifiers have no large rotating masses which must be brought up to speed before going on the line. No warm-up period is required—no waiting for vacuum build-up. This means the I-T-E Mechanical Rectifier has maximum availability for your process.

For further information, write I-T-E Circuit Breaker Company, 19th and Hamilton Streets, Philadelphia 30, Pennsylvania. Ask for Bulletin 5106.

The 10,000 ampere mechanism pictured will supply d-c power to a chlorine cell line.

INSTALLATION IS FAST, TOO!

A complete installation can be unloaded, installed and placed in operation in a relatively short time. This is possible because of:

- Packaged delivery.
- Factory-wired and labeled control circuits.
- Truck-mounted, movable rectifying units.
- Overhead bus (no trenches or basement preparation).
- Compactness of the design.

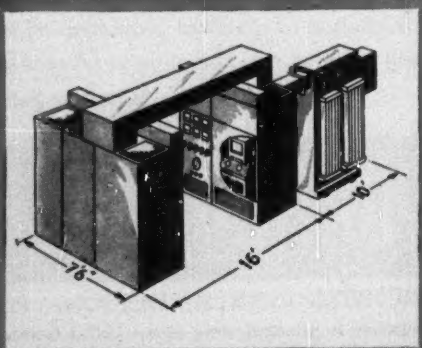
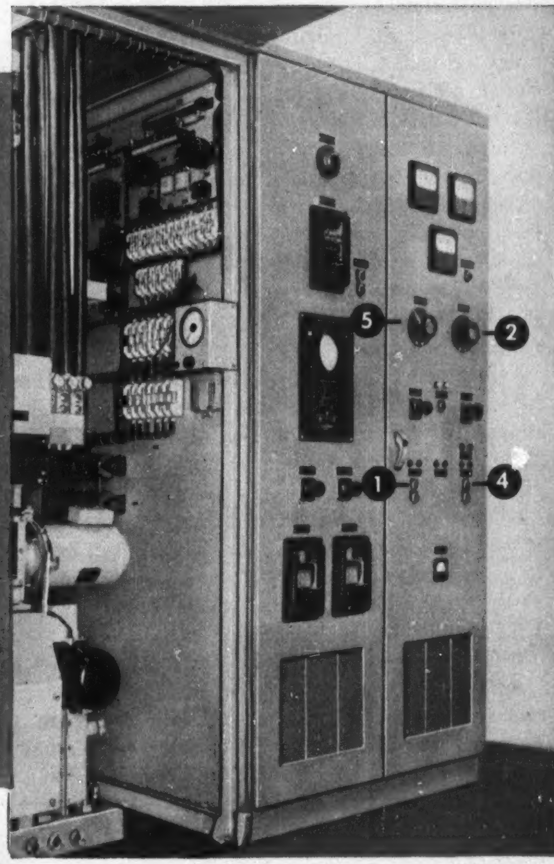


Diagram of typical mechanical rectifier installation. All elements of the unit including operating aisle are arranged in an area of 120 square feet. This does not include area occupied by transformer which is usually located outdoors.



the manufacture of condensation and addition polymers. It's also used to upgrade drying and semi-drying oils, and in the manufacture of wetting agents, soil conditioners, textile finishes, pharmaceuticals, fungicides and insecticides. Fumaric acid has many of the same uses and is also a valuable food acidulant and baking powder ingredient.

Du Pont to produce new polyester film

Early this year Du Pont will begin construction of the first commercial plant for the manufacture of its new polyester film. The $10 million plant will be built on a 435-acre site bordering the Scioto River about two miles south of Circleville, Ohio. Production will start early in 1955 and the plant will employ about 250 when it reaches peak output.

Chemically, the new polyester film, called Mylar, is polyethylene terephthalate. It's made from ethylene glycol and terephthalic acid, chemicals derived, in turn, from natural gas and petroleum. Thus it is chemically similar to Du Pont's new polyester base for photographic film and to Dacron, Du Pont's polyester fiber. But unlike Dacron, which is spun, Mylar is made in continuous sheets.

A product of fundamental research by Du Pont, Mylar is an entirely new film. It can be made either transparent or translucent. It is two to eight times stronger than other commercial films. Mylar has a tensile strength of 25,000 psi., one-third that of some high-quality steels. Its impact strength is at least twice that of any known commercial film. Thus it can be made in gages as thin as 0.00025 in., only one-third as thick as the thinnest films now produced commercially by Du Pont.

The new polyester film has the capacity for storing electrical energy, and also possesses high dielectric strength without excessive power loss. Its strength and electrical properties change little over a wide range of temperatures and humidities. As an insulator it can be used at temperatures from −94 deg. F. to 392 deg. F. and still retain most of its strength and insulating qualities.

Most immediate use anticipated is in electrical insulation for motors, condensers, cables, coils and transformers. It's likewise expected to widen industrial use of tapes for strapping and reinforcing. Another possibility is as a base for long-lasting magnetic sound-recording tape. Mylar will probably be laminated with other materials, and may be metallized by depositing a microscopically thin layer of aluminum or other metal on it. Other uses, requiring further research and development, include packaging and plastic glazing.

Mylar now sells for $3 to $4 a lb., depending on thickness. Costs are expected to tumble, however, as volume production gets under way. Cellophane, for example, sold for about $2.65 a lb. when Du Pont started to make it in 1924; today it sells for about 55c. a lb. But it's unlikely Mylar will ever sell as low as cellophane because of the higher cost of raw materials and the more intricate chemical process involved in its manufacture.

The new film results from pioneering research by the late Dr. Wallace H. Carothers of Du Pont on condensation polymers. Before he shifted his efforts to polyamides and nylon, Carothers and his group had discovered a polyester that could be drawn into a fiber. British researchers, following Carothers' lead, came up with a polyester fiber now sold by Imperial Chemical Industries in England as Terylene. Independently, Du Pont chemists had also been following up the early work of Carothers on condensation polymers. When Du Pont learned of the British research it purchased rights covering the development in which it was interested. After further research by Du Pont, Dacron polyester fiber was produced. Next, Du Pont developed its photographic film base, and finally Mylar polyester film. So far, Du Pont has spent more than $5 million for research to develop the polymer for film use and to get information needed for process development and plant design. Research will continue for many years to exploit the potentialities of the new polyester film.

Booming antibiotics

More and more, antibiotics are becoming the backbone of the U.S. pharmaceutical industry. In 1939, the industry's output of ethical drugs was estimated at about $157 million. The first antibiotic, penicillin, was introduced in 1942.

By 1947, the industry's sales of ethical drugs had soared to about $532 million, and by 1951 to $1.1 billion, with antibiotics accounting for about 43 percent.

Trend today is increasingly toward developing new antibiotics that are effective, not against many different bacteria, but against one or a very few organisms. "It seems likely," says Graydon L. Walker of Parke, Davis, whose chloromycetin has been administered to more than 8 million people since 1949, "that the antibiotic ammunition of the future will fit a rifle, rather than a shotgun."

New challenge in the skies

Rockets and guided missiles are opening a whole new realm of opportunities to the chemical process industries. New chemicals are needed to fuel these rockets and missiles, new ceramics and new metals and alloys are needed to build them. These opportunities challenge the ingenuity and imagination of engineers in the process industries. And make no mistake about it, guided missiles are fast catching up with conventional aircraft in importance.

By 1960 the U. S. Air Force, for example, will be splitting its procurement money 50-50 between piloted planes and guided missiles. Procurement for guided

(Continued on page 108)

missiles jumped from $12 million in fiscal 1950 to $149 million in 1951; it was $130 million in 1952, and is $300 million for current fiscal 1953.

"We hope to keep accelerating the program at this rate," Air Secretary Thomas K. Finletter recently declared. "We want it to move forward as fast as possible," he added.

Meantime, aircraft and related procurement, now at a peak of $12.6 billion, will drop to substantially below $10 billion in fiscal 1954 and may level off at $6 billion annually by mid-1955, while expenditures for guided missiles continue to rise.

Rare earth producer expanding

Lindsay Chemical Co. of Chicago plans to expand facilities for production of rare earths. Security muffles disclosure of what rare earths or rare earth chemicals will be produced, as well as the size and cost of the plant expansion.

However, the expansion has been approved by Chicago's Industrial Dispersion Committee, acting at the suggestion of the government. And the federal plant dispersion program applies to plants over $1 million in value and to plants producing 15 percent or more of defense requirements of a specific product.

Lindsay is probably the world's largest producer of rare earths and rare earth chemicals. Lindsay produces about 85 percent of all industrially used rare earths. Maywood Chemical Works of Maywood, N. J., comes next, producing close to 10 percent, and Rare Earths Inc. of Paterson, N. J., is third. Small companies account for the balance.

Dr. Frank H. Spedding in Ames, Iowa, got the job during the war of producing extremely pure rare earths for the Manhattan District. He used ion exchange principally, and made several improvements in processes. However, since all of this work was done and still is being done for AEC, which gets the rare earths produced, little can be told about it. But these products are far purer than industry requires and too costly for commercial use.

Gold miners turn sulphuric producers

Sulphuric acid from pyrites looks like an offshoot of uranium extraction at South Africa's gold mines in the Johannesburg area. Government Areas, one of the older mines of the East Rand, is installing a $350,000 pyrites recovery plant; the pyrites will be used to manufacture sulphuric. While no uranium extraction plant is presently planned at the mine of Government Areas, other mines where uranium will be extracted also expect to make sulphuric from pyrites.

Sulphuric acid will be used in the new ion exchange process for extracting uranium from gold ore residues. It is also needed to convert phosphate rock into superphosphate fertilizers. South Africa's soils are deficient in phosphates. Ultimately, South Africa might even become an exporter of sulphuric acid made from pyrites contained in its deposits of gold ores.

Process industries hear call of the north

Saskatchewan seeks new industry, especially process industries, to develop its abundant natural resources. Special inducements are offered to U. S. investors.

For certain types of new industry Saskatchewan will guarantee loans, help obtain fast tax writeoffs from the Canadian government, and furnish information on labor, markets and raw materials.

U. S. interests are negotiating with Saskatchewan on an oil refinery, a uranium processing plant, pulp and paper board plants, a fiber board mill and a plywood plant. The province especially wants wood pulp firms. It will promise year-round delivery of lumber to the mill at a fixed price and maintenance of roads.

To encourage new ventures, Saskatchewan will even match investors dollar for dollar on desirable enterprises.

Lubricant for rocket motors

Modern rocket motors in aircraft and missiles call for lubricants that can withstand powerful oxidizing agents. A lubricant stable in fuming nitric acid, dilute acid and water, and insensitive to shock and impact while in the fuming nitric acid has recently been developed, according to the U. S. Air Force.

This new grease might be used to lubricate parts of rocket motors and also equipment used by ground crews in handling strong oxidizers. At present, two grades of the lubricant are proposed for use to cover the temperature range from —65 to 160 deg. F. But the Air Force wants a single grease for the entire range.

Victory through air power

Fliers logged over 700,000 hr. of flying time in a recent year flying close support missions for the nation's farmers in their all-out battle to protect crops.

Total hours flown, acres treated and quantity of pesticides put down, as well as the use of airplanes for other agricultural purposes, were recently reported for 1951 by the Civil Aeronautics Administration.

This flying time was spent in applying pesticidal dusts, sprays and baits, as well as seed and fertilizer. Nearly 40 million acres were treated. Spraying communities to control insects accounted for flights over 1½ million acres of the total area covered.

By far the biggest quantity of material applied was dusts and sprays of insecticides, fungicides and similar chemicals. The fliers dropped 275,807,808 lb. of dust, 35,654,711 gal. of spray and 2,386,545 lb. of bait. In addition, they sowed 91,118,408 lb. of seed and distributed 218,192,333 lb. of fertilizer—all in all, a hefty tonnage of agricultural chemicals delivered on target by the air arm in support of the embattled farmers.

What's Happening, turn to page 110

between the pitch and the pan...

CHEMISTRY

It takes more than a song to sell soap...between the studio and our housewife's kitchen lie years of market analysis and chemical research; for developing soaps and synthetic detergents that make her job easier is essentially a chemical process.

Closely associated with the soap industry for 60 years, Mathieson was one of America's earliest producers of chemicals used to manufacture soap. And here's *our* pitch: today Mathieson is the only producer of all these primary soap and synthetic detergent chemicals—caustic soda, soda ash, ammonia, bicarbonate of soda, sodium chlorite, sulphuric acid, and ethylene oxide.

A dependable source of essential raw materials is always important. If your production requires these chemicals—or any of Mathieson's many organic, inorganic or agricultural chemicals—you may be able to buy *to better advantage* by consulting with us now.

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CHEMICALS

1170

MATHIESON CHEMICAL CORPORATION • BALTIMORE 3, MARYLAND

What's Happening

Goodyear Starts $1.5 Million Synthetic Rubber Expansion

A $1.5 million expansion is planned by Goodyear Tire & Rubber Co. in chemicals. Construction has begun on added facilities for production of synthetic rubber at Akron, Ohio.

The expansion will make available additional reactors for production of synthetic rubber used in paints, as rubber reinforcing agents and for other uses.

The new facilities can also be used to produce synthetic rubber latices, which go into water emulsion paints and are used in paper and fabric coatings.

New Dow Plant in Texas To Make Ethylene Dibromide

Ethylene dibromide will be produced in a huge new plant that Dow Chemical Co. will build at Freeport, Tex., at a cost of more than $8 million.

So far, Dow has let no contracts but the plant has been planned for some time. A fast tax writeoff has been granted by NPA for the project.

At present, Dow does not make ethylene dibromide in Texas. But the company has been producing it at Midland, Mich.

Appraising of Rubber Plants Points to Disposal by RFC

Low bid of $114,000 for an engineering appraisal of the present value of the synthetic rubber facilities now owned by the RFC was submitted by the Ralph M. Parsons Co. of Los Angeles, Calif. The appraisal is the first step in the government's plan to dispose of the 23 plants.

Other bidders were Day & Zimmerman, Inc., of Philadelphia, the Wyatt C. Hedrick Engineering Corp. of Houston, Tex., and Ford, Bacon & Davis of New York.

Rubber industry representatives recommended the engineering appraisal to RFC. Facilities to be appraised include copolymerization plants, butadiene production facilities, a styrene plant and other related facilities.

The plan for disposal of the government-owned synthetic rubber plants is due to be submitted to the President by March 1, 1953.

Monsanto Now Producing Plastics in Ohio Plant

Production of industrial resins has begun at the newly acquired plant of Monsanto Chemical Co. at Port Plastics, Ohio.

Located on a 115-acre site on the bank of the Ohio River near Cincinnati, the plant is expected to become a major Midwest production and distribution point for Monsanto plastics. Operations will supplement those at the company's Springfield, Mass., plastics plant. Monsanto has also been producing its Krilium soil conditioner at Port Plastics since last spring.

Atlas Now Manufacturing New Solid Polyester Resin

A new solid polyester resin is now being produced by Atlas Powder Co. of Wilmington, Del. After dissolving in styrene, it possesses a viscosity in the low range required for application to glass fibers or other types of preforms by spraying, dipping or brushing.

Like other dry polyesters made by Atlas, the new resin is supplied in the form of free-flowing granules. The resin also has the advantage of low exotherm with room temperature catalysts.

SPOT NEWS

Added Capacity Planned for Tetraethyl Lead Chemicals

Expansion goals for two chemicals used in production of tetraethyl lead have been set by DPA.

The goal for ethyl chloride was set at 630 million pounds by January 1955, an increase of 200 million pounds over annual capacity in January 1951. Added facilities to lift ethyl chloride capacity will cost $85 million.

Ethylene dibromide goal calls for capacity to produce 210 million pounds by the beginning of 1955, a boost of 90 million pounds over annual capacity in January 1951. Cost of the added ethylene dibromide facilities: $10.5 million.

Goals for these two chemicals were established to meet the goal of 570 million pounds for tetraethyl lead. This represents an expansion of 150 million pounds over the 1951 capacity and is to be reached by January 1954. Tetraethyl lead is needed in the production of high-octane aviation gasoline.

Ethyl chloride is also used in the manufacture of ethyl cellulose and as a refrigerant, anesthetic and solvent. Ethylene dibromide also is used in medicinals, in synthesis of organics and as a solvent.

Ethyl chloride is produced from ethylene or ethyl alcohol and hydrogen chloride. Ethylene dibromide is primarily derived from ethylene and bromine.

in Chemical Engineering

They Put It Out in 37 Seconds

And they—Socony-Vacuum—did it with nothing but compressed air. It's the most significant method of fighting oil fires ever developed.

The biggest deliberate fire this side of the River Styx was touched off on the banks of the River Delaware a few weeks ago. And then this billowing inferno—an open tank containing 2 million gal. of No. 2 fuel oil fully ablaze at the surface—was completely snuffed out in 37 seconds flat.

Socony-Vacuum at its Paulsboro, N. J., refinery engineered the show without a hitch for some 500 observers, including a representative from Saudi-Arabia and visiting firemen from Paulsboro.

This new technique—called the agitation method—consists simply of injecting air into the lower areas of the tank. This brings cold liquid to the top and reduces the supply of vapor, which is, of course, the only phase actually burning.

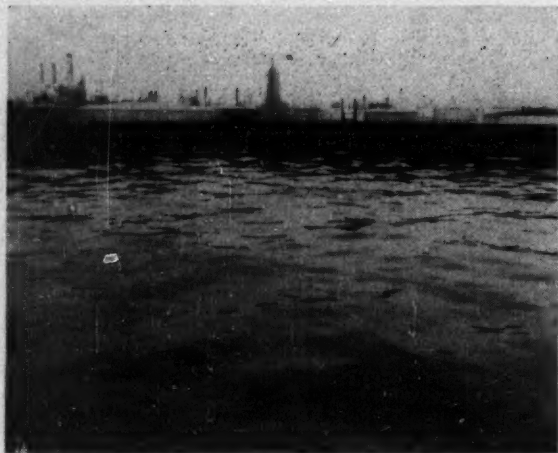
Socony's safety and fire protection chief, Joe Risinger, developed the idea to its present stage* and demonstrates it with the stage presence of Harry Houdini and the glee of a father with a new set of electric trains. Risinger calls his process the "tuxedo method" of fire-fighting (you can put a fire out in your best suit) and proves it by taming open gasoline tank fires to a mottled chorea of flame and then finishing them with a squirt or two of foam.

▶ **Cheap Protection**—Significant is the fact that practically no new investment is needed to protect existing tank farms. All the refiner has to do is bring in a line of compressed air to each tank.

Existing lines used for pumping oil in, stirring it, or cleaning the bottom of the tank can be used to pump in air for agitation. Socony demonstrated this at Paulsboro by putting out the big tank (115 ft. in diameter and 30 ft. high) in 125 sec. with use of only the triple-cross piping system. The 37-sec. putout was accomplished with 1,000 cfm. air from a center line and shell points around the side of the tank.

Altogether Socony burned up only 6,500 gal. of No. 2 fuel oil in three ignitions and putouts, or a total of

* The cooling effect of oils has long been recognized, even though the fuller implications were less readily perceived. In the middle 1920's L. B. Van Leuven, of the Vacuum Oil Co. (merged in 1931 with the Standard Oil Co. of New York) experimented with agitation by air to prevent crude oil boil-over. And in more recent years, J. H. Burgoyne and L. L. Katan in England have done similar work on a somewhat smaller scale than Socony.



UNAGITATED: Here's how the big tank looked before the fire.

AGITATED: Cooler liquid from tank's bottom starves the fire.

about 0.3 percent of the 2 million gal. of fuel in the tank. For each of the tests the tank was ignited at three points at its periphery, then allowed three or four minutes to really get blazing.

▶ **How It Works**—Basic fact about any flammable liquid fire is that burning can take place only when vapors and air are both present above the liquid in proportions that will form and support a combustible mixture. When these proportions are outside the combustion limits, the mixture of vapor and air becomes noncombustible and the fire simply is starved to extinguishment.

▶ **Common Denominator**—Every effective method of extinguishing or controlling oil fires operates by attacking one or both of the two ingredients of a fire—the air and the vapors—in one way or another. The method of using inert gas is based on reduction of the supply of air below the proportion required for a combustible mixture. Extinguishment by foam reduces the release of vapors below the minimum needed for a combustible mixture, and also excludes the air.

Agitation, though, differs from conventional methods by accomplishing its job through rearrangement of the contents of the tank of burning liquid rather than through addition of a smothering agent to the surface. In short, the agitation process uses the liquid itself to extinguish or control the fire that the liquid's vapor is supporting. This by forcing cooler liquid from the lower part of the tank to the burning area at the surface.

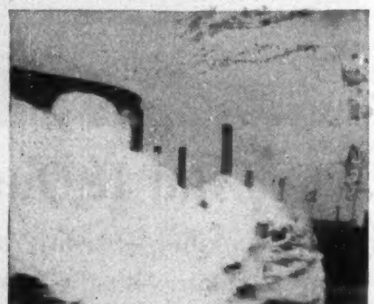
The cooler liquid gives off less vapors than the warmer liquid it replaces. This action either reduces the amount of vapors below the point required to sustain combustion, extinguishing the fire, or reduces the rate of mixing of vapors and air sufficiently to make it possible to put out the fire with smaller amounts of conventional materials and equipment.

Agitation can completely *extinguish* fires of oils that have flashpoints above their storage temperatures or that have fairly low vapor pressures. Examples are kerosene, fuel oils, diesel fuels, linseed oils, and some crude oils. In tougher cases, the agitation process can *control* fires of oils that

This is slop-over; it needn't happen in future tank fires

NO FOAM

FOAM APPLIED



AFTER MUCH FOAM

have flashpoints below their storage temperatures and that have high vapor pressures. Examples of these are gasoline and some crudes.

Crude oil fires establish a temperature gradient which grows deeper with continued burning. This front moves downward through the product at a rate ranging from about 4 in. to about 4½ ft. per hr., thus steadily raising the temperature of the product below the burning surface.

This creates two hazards in crude fires—slop-over and boil-over. Slop-over tends to occur when foam is applied to the burning surface of the crude. The water in the foam is converted to steam and is expanded as much as 1,700 times. The explosive character of this rapid expansion frequently froths the burning oil out over the sides of the container, creating a hazard to fire fighters close by. It should be pointed out, though, that when sparingly applied, water can cool the heat wave and thus help avoid slop-over.

Boil-over is similiar to slop-over. Water, in greater or lesser quantity, is almost invariably present in the bottom of crude tanks, even though it is below the take-off line and therefore does not contaminate the crude. When a crude oil with a wide boiling range is burning, the more volatile hydrocarbons burn away, and the heavier, heated ones drop down toward the water beneath the oil. There they convert the water to steam, which, expanding too rapidly to pass readily through the oil "explodes" and boils the oil over the top of the tank. The agitation method obviously prevents both of these.

Socony has fully tested the agitation method during the last two years and has filed a patent application on the process. In the interest of safety, though, the company will make the patent available, without charge, to anyone who wishes to use it.

Alaskan Mill to Burn Waste From Magnesia Pulping

The Alaskan Territorial Water Pollution Control Board has given its final approval to plans of Ketchikan Pulp Co. for a waste disposal system to be installed at its Ward's Cove plant under construction near Ketchikan.

The system, calling for recovery of a new type of cooking liquor containing magnesium oxide, was developed by Weyerhaeuser Timber Co. at Longview, Wash. The waste liquor will be burned and used as fuel in generating steam for the mill. The new Alaskan pulp plant is expected to be completed early in 1954.

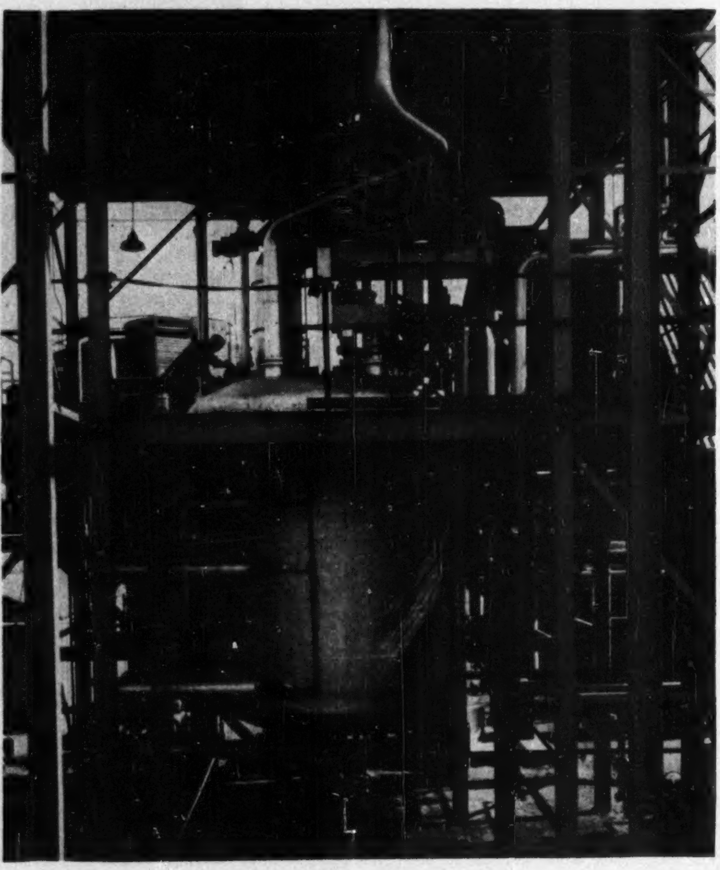
Shell Recovering Sulphur From Waste Refinery Gases

Up to 55 tons of elemental sulphur will be recovered daily from waste refinery gases in a new unit at the Houston, Tex., plant of Shell Chemical Corp.

In the recovery process, hydrogen sulphide contained in waste refinery gases will be catalytically converted to 99.5 percent pure sulphur at an annual rate exceeding 13,000 tons.

An unusual feature: molten sulphur will be stored in an underground tank at 300 deg. F. It will remain molten throughout loading and transporting in specially insulated railroad tank cars.

Sulphur recovery is not generally a part of petroleum refining, but with annual U. S. sulphur production trailing U. S. consumption, especially for sulphuric acid, the nation's petroleum industry has moved to take up the slack. Over 40 plants for recovering sulphur from hydrogen sulphide are either planned, under construction or in operation in the U. S. today.

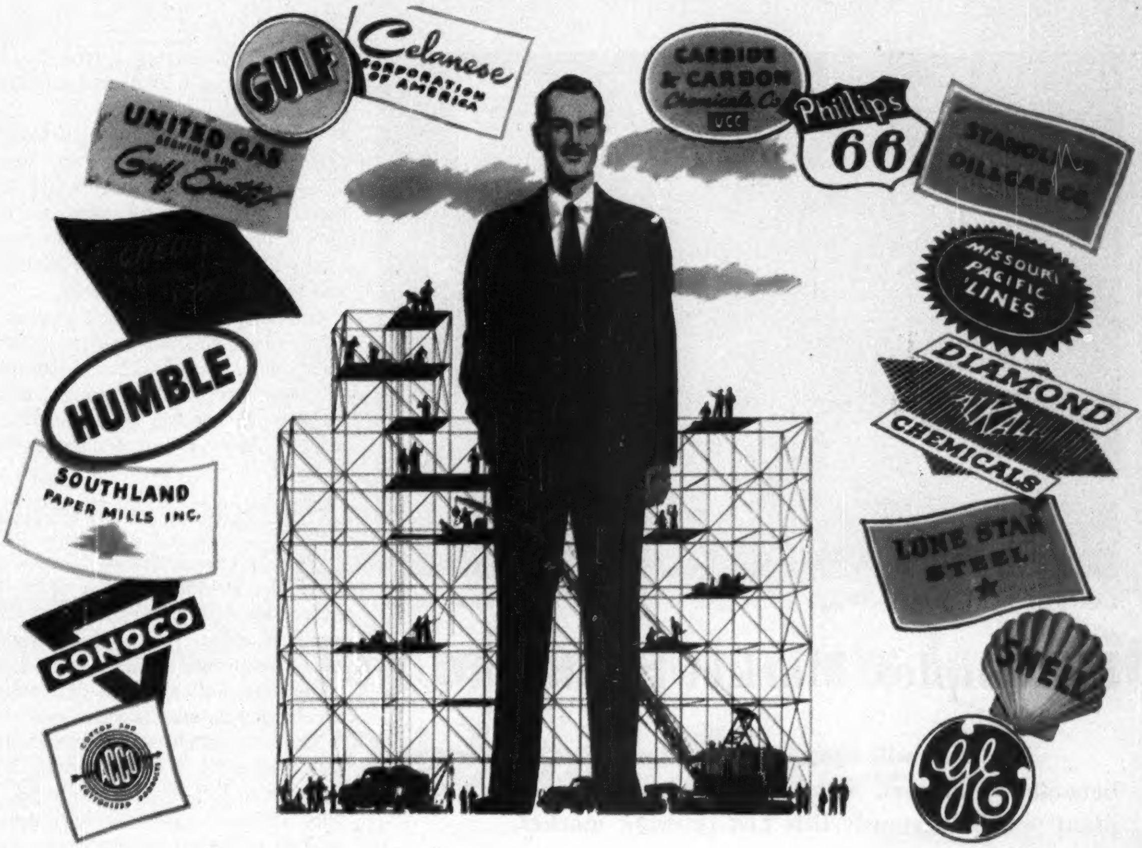


RESIN KETTLE WILL DEFY NORTHERN WINTERS

First outdoor installation for resin production in the North, this resin kettle will be watched closely by northern industrialists to see how it withstands a New Jersey winter.

Just completed at the Elizabeth plant of Reichhold Chemicals, the 7,800-gal. kettle cost $500,000. It can cook a 50,000-lb. charge at temperatures up to 600 deg. F. Unique insulation precautions protect it against the cold.

If the Elizabeth experiment succeeds, there will be many more outdoor plants in the North. They will be cheaper, far safer and easier to operate.



How to Build Satisfied Clients!

We don't intend to brag . . . but we do like to talk about our satisfied clients. In their ranks are listed the greatest names in American industry. Their fields of endeavor vary from the chemical industry to the petroleum industry —from electric utility plants to gas transmission—from railroads to the construction of complete municipalities.

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LARGEST CUSTOMERS—Animals are the cause of sharp jump in B Complex output.

B Complex Market Shifts

Animals will soon outstrip humans as consumers of beta-alanine-derived vitamin B complex. Goodrich's new plant will help supply this fast growing market.

To build its first commercial plant for beta-alanine this year, B. F. Goodrich Chemical Co. had to defy the steel shortage by moving a building. But they were that anxious to expand production of this amino acid, all of which goes into making an essential ingredient of vitamin B complex, calcium pantothenate.

The big rush centers on a new, fast expanding market for "cal pan" in the animal feed industry. Until two or three years ago all the cal pan produced was used in vitamins for humans. That market is still growing steadily but unspectacularly.

▶ **Switch to Animals**—From 1950 to 1951 sales of beta-alanine rose from 93,600 lb. to 152,000 lb., production from 131,800 to 207,000 lb. a year. Bulk of the rise went into animal feed. Goodrich predicts that this outlet will soon dwarf that of vitamins for human consumption.

Sharing this view are the other, older, beta-alanine producers: R. P. Scherer Corp., Detroit; Abbott Laboratories, North Chicago; Nopco Chemical Co., Harrison, N. J.; Bios Laboratories, New York. These companies, unlike Goodrich, go on to produce calcium pantothenate from their beta-alanine via reaction with butyraldehyde. Goodrich is the only merchant producer of beta-alanine selling to all cal pan producers. Other producers of cal pan are Mallinckrodt, Marine Products, Merck, New York Quinine, Pfizer and American Cyanamid, with Cyanamid reported as having the biggest output.

One of the ingredients that makes B-complex vitamins an important factor in animal growth, cal pan occurs naturally in grains. The natural product is no more effective than the synthetic and is its only competition. Amounts to be found in nature vary with the type of grain and yearly crops.

Although Goodrich started to make beta-alanine in pilot-plant quantities in 1948, commercial production began this past April. To get the steel for its commercial plant the company had to: Dismantle a building at its Akron plant last fall, move the framework to Avon Lake, rebuild the building using all new brickwork. The plant has been designed so that its capacity can be doubled quickly.

For some time Goodrich has been making its beta-alanine raw material, beta-propiolactone, at Avon Lake. It is formed by reacting ketene (made from acetone, also at Avon Lake) and formaldehyde.

▶ **Simpler Process**—According to Goodrich, its one-stage process for beta-alanine is simpler than competing processes—at least two stages are required for the other two known processes. One is based on acrylonitrile and the other on acrylic esters.

Goodrich introduced beta-propiolactone in 1947 and, as a result of experiments with that chemical, discovered the new process for making beta-alanine. It consists of an addition reaction between ammonia and the lactone.

$$NH_3 + \underbrace{CH_2CH_2C{=}O}_{O} \text{ — } NH_2CH_2CH_2COOH$$

This isn't as simple as it looks because the lactone ring can open on either side of the oxygen when ammonia is added. In one case it yields an amide instead of the amino acid. Close control of conditions determines which reaction takes place.

Since Goodrich started producing beta-alanine in 1948, the price has been cut in half—from $7.50 to $3.75 a lb. The price will probably continue to drop as the market grows.

▶ **Getting Into the Act**—Indications are that B. F. Goodrich will soon yield its position as beta-alanine's newest commercial producer. Several other firms, as yet unwilling to be identified, are reported to be eyeing the market hungrily.

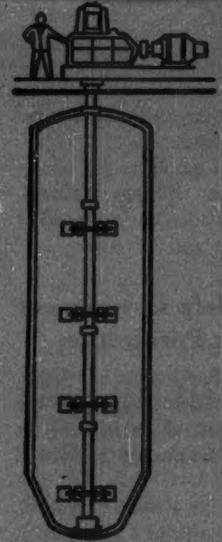
So far, Goodrich hasn't turned up any uses for beta-alanine other than the production of cal pan. But it has found other alanines that have potentialities. Most notable of these is dodecyl beta-alanine, a surface-active agent with applications in the detergent field. This is still on an experimental basis, however.

Pipeline Will Carry Products From Refinery to Spokane

Continental Pipe Co. of Ponca City, Okla., a subsidiary of Continental Oil Co., will string a $16 million pipeline from Conoco's Billings, Mont., refinery to Spokane, Wash.

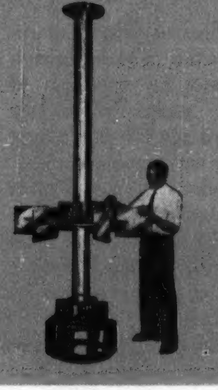
Construction of the 600-mi. pipeline, 8 in. in diameter, will begin as soon as final negotiations are completed and the government approves use of pipe and other materials, according to President W. L. Kygar.

The pipeline will eventually carry 25,000 bbl. a day of refined petroleum



NO INTERMEDIATE BEARINGS needed to support the 47-foot mixer shaft. Flex-protected gear reducer quill permits using shaft with bottom steady bearing only. Shaft is in 10-foot sections for easy handling, installation. Alignment is insured by rigid flanged couplings with close-tolerance machined rabbet fits.

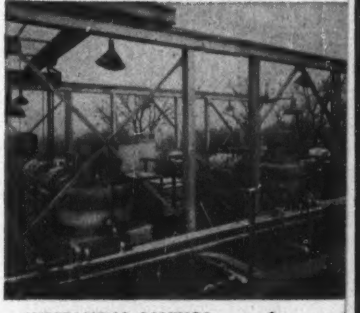
BIG TURBINES are split to pass through 18-inch tank opening and save special tank construction. Steady bearing is split too. Stainless turbines are standard bolted construction, with discs drilled so blades can be removed or added to suit process conditions. Adding blades results in a stepwise increase in HP level.



Big mixing job costs less with *Lightnin*® *Mixers*

Here's an unusual mixing problem solved with *standard* equipment . . . six 200-HP LIGHTNIN Mixers dispersing air for antibiotic fermentation in 25,000-gallon tanks at Commercial Solvents Corporation, Terre Haute, Ind.

It shows how MIXCO engineers can adapt *standard* LIGHTNIN Mixers to a *custom* processing job, and save you money. Your LIGHTNIN Mixer representative will be glad to assist you with your fluid mixing requirements—or write us direct. For catalog information about LIGHTNIN Mixers check and mail the coupon.



SUBSTANTIAL SAVINGS come from using *standard* equipment on big mixing jobs, like this battery of LIGHTNIN Mixers at a Commercial Solvents Corporation plant.

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- ☐ B-104 Side Entering Mixers
- ☐ DH-50 Laboratory Mixers

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Company......................................

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products. Marketing arrangements are as yet not disclosed.

Light oils and gasolines are manufactured at the Billings refinery. Conoco has considerable oil production in Montana and Wyoming.

Experts to Help Government In Sea Water Purification

Nine outstanding leaders in science, education and industry will advise the U. S. Department of Interior in its research on purification of saline and brackish water.

The nine are: Dr. Robert G. Sproul, president, University of California; J. J. Cronin, vice president, General Motors Corp.; Dr. Louis Koenig, director of research, Southwest Research Institute, San Antonio, Tex.; Henry J. Schmitt, editor and publisher, The Aberdeen American-News, Aberdeen, S. D.; Dr. Lee A. Du Bridge, president, California Institute of Technology; Dr. George D. Humphrey, president, University of Wyoming; Dr. Sheppard T. Powell, consulting engineer, Baltimore, Md.; Dr. Frederick L. Hovde, president, Purdue University; and Dr. James R. Killian, Jr., president, Massachusetts Institute of Technology.

One of the principal reasons for initiating the program is to assure enough water at all times for operation of defense plants, especially in the heavily populated coastal areas where many industries are concentrated.

"The population of the United States," says Interior Secretary Oscar L. Chapman, "has increased more than 600 percent in the last 100 years, and the total use of water has increased far beyond that."

The government program encompasses long-range research into methods of converting sea water into drinking water for use in coastal areas and also research into ways of purifying brackish water for irrigation, industrial and household purposes in the interior regions.

While sea water conversion is the major project, solutions will be sought for water in the brackish areas that could be used for irrigation. There is hardly a state that would not gain from the development of an economical process for the purification of brackish and saline water. There is intense international interest in the development of a sweet water supply.

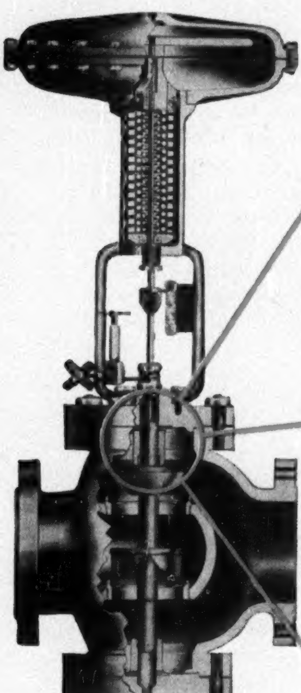
Have a preference... a special application?

There's A Standard Teflon Stuffing Box

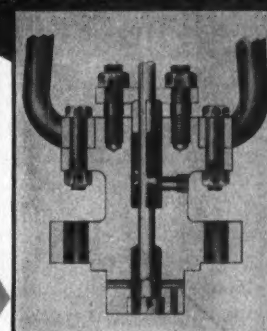
for the BS&B Climax Controls needed in your processing

The use of Teflon in Climax Controls stuffing boxes is standard procedure with BS&B. There's a Climax Teflon stuffing box to meet any preference. Here, we show three of them as applied to Climax Diaphragm Control Valve Type 86. BS&B stresses correct stuffing box design because design has such a great effect on hysteresis. Any friction in the valve may result in improper operation and unsatisfactory service. To further overcome the threat of friction, the lower stems in all Climax Controls of this type are super polished.

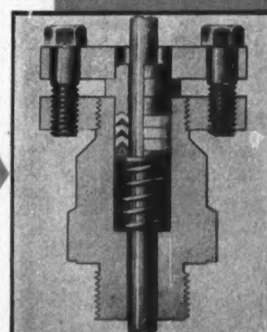
Teflon resists almost all known corrosive fluids. It's self lubricating and means less friction. Spring loaded Teflon reduces maintenance which might normally result from packing nut being applied too tightly.



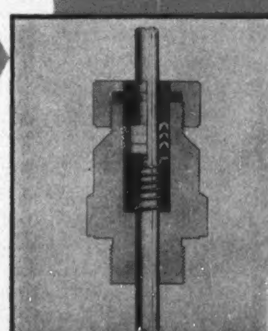
Teflon or Standard bolt stuffing box. *The top works or yoke of the valve is removable without disturbing the stuffing box. This stuffing box is applicable to Climax Controls, Types 86, 73, 1286, 87, 15, 115 and 1486.*



Bolt-down type, spring loaded Teflon *using CVU Ring. Available for, or present standard stuffing box can be converted to, the following Climax Controls, Types 86, 73, 1286, 87, 15, 115, 1486, 125, 120, 128, and 58.*



Standard Packing Nut stuffing box. *Screwed down packing nut design assures minimum frictional lag and a minimum of maintenance. Features the dependable CVU Teflon Ring. Can easily convert old style valves using standard stuffing box to Teflon packed.*



The type of stuffing box you require depends on . . . (1) The fluid being handled (2) Individual maintenance problems. The interchangeability of Climax Controls stuffing boxes is highly important to both old and new users. Teflon stuffing boxes are actually standard with Climax and can be included when controls are ordered . . . or conventional type stuffing boxes can be interchanged with Teflon stuffing boxes in the field with a minimum of time and effort. Tell us what fluids you're handling and what your problems are . . . then let us make a recommendation — Write . . .

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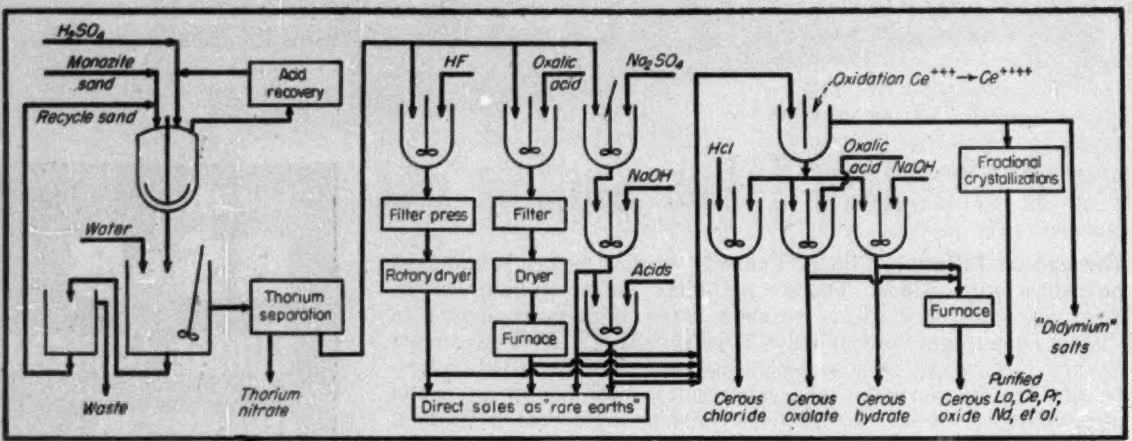


Rare Earths Now Medium-Rare

New uses just getting under way will up demand for rare earth chemicals by two to four times within the next five years. Much depends on availability of ores.

Any definition of rarity when applied to material substances must include the dimension of time. One group of materials in particular has maintained for years its distinction of rarity.

These materials—known classically as the "rare earths"—are now threatening to throw off their shackles and join free society as commercially available substances.

Significant increases in the use of rare earths is the current outlook. New uses, to mention only a few, include alloying agents for aluminum and magnesium, in television lighting, neutron absorption in atomic piles and high-temperature refractories.

Recently announced 1955 goal set by DPA is 7,000 net dry tons per year of rare earths containing 50 percent rare earth oxides. This represents a 50 percent increase over 1950 supply from foreign and domestic sources.

► **Depends on Ore Supply**—Though a good deal of anticipated expansion in use hinges on the defense program, a lot more depends on the basic economics of ore availability. Rare earth production, in terms of tons of ore processed, is expected to double within the next five years even with present outlook for ore supplies (see table). If big new deposits are discovered, bringing ore prices down, this figure may be redoubled.

Traditional ore source has been the monazite beach sands of Travancore, India. Imports during 1943 amounted to nearly 5,000 tons, but very little reached the U.S. during the latter part of the war. Realization of the atomic energy significance of the thorium content of monazite brought an embargo by India in 1946.*

In 1947 Brazil came through with 2,300 tons, but soon followed India's lead and embargoed further shipments. Since that time our entire supply of ores has come from Idaho and Florida.

► **California Ore**—Deposits of another ore—bastnasite—have been found in California's San Bernardino County. Molybdenum Corp. of America began processing this ore last year, upgrading it from 15 percent rare earths to 30-40 percent.

If this and possible future ore discoveries can succeed in bringing down the cost of ore, rare earths may eventually go into such uses as luxury glass tableware, fine camera lenses and even beer bottles.

There's little difference between monazite and bastnasite. Both have about 31 percent Ce_2O_3. Monazite, an orthophosphate, has about 15 percent La_2O_3, 9.3 percent Nd_2O_3, 3.1 percent Pr_6O_{11}, 2.2 percent Sm_2O_3 and about 1.0 percent other rare earths. Bastnasite, a fluocarbonate, is higher in lanthanum (18-22 percent La_2O_3) and proportionately lower in other RE's.

► **Process Engineering**—Chief producer of rare earth chemicals is Lindsay Chemical Co., West Chicago, Ill. The following process description and the above flowsheet are based on information obtained from Lindsay.

Monazite is "opened" by heating with sulphuric acid in gas-fired, cast iron pots with anchor agitators. The rare earth and thorium sulphates formed are discharged to a tank and dissolved in water. Unreacted sand, amounting to 1-5 percent of the original charge, is recycled.

Thorium is next separated by a process whose details are at present under security wraps. RE salts are then precipitated to free them of phosphoric acid formed during opening of the sand. Precipitating agent depends on the end product desired,

* Within the past few months news has been received of the start-up of Indian Rare Earths Ltd.'s facilities to process the Travancore monazite sand deposits. The Indian government is said to own 55 percent of the stock interest.

Uses of Rare Earths

	1942	1952	1957[1]	1957[2]	1957[3]
Ore processed (as monazite), tons....	1,500	2,500	5,000	10,000	10,000
End Uses					
Flints..........	40%	25%	10%	10%	5%
Optical glass polishing..........	—	25	5	10	25
Carbon cores..........	40	25	5	10	20
Glass..........	} 20 (Glass, Export, Miscellaneous)	} 25 (Glass through Alloys)	5	10	3
Export..........			5	10	0
Miscellaneous..........			5	10	2
Alloys..........	—		65	40	45

[1] Normal expansion [2] If big deposits discovered, prices down [3] War

and a number are used; the usual ones are HF, oxalic acid and sodium sulphate.

If HF is used the precipitate passes to a filter press, thence to a specially designed rotary dryer, to give RE fluoride. Likewise with oxalic acid the precipitate is filtered and dried. The RE oxalate may be sold as such or converted to RE oxides in a rotary (large batches) or muffle (small batches) furnace.

Double sulphates precipitated with sodium sulphate may be sold as such or converted with caustic to RE hydrates. Some cerium and most of the yttrium earths† remain in solution.

Any of these RE mixtures can be further processed to separate cerium. Lindsay oxidizes trivalent cerium to tetravalent to achieve this separation. Tetravalent cerium precipitates at pH 2.7, whereas the trivalent form comes down at pH 6.3-8.2.

▶ **Diminishing Returns**—Cerium-free rare earths are treated in a multitude of ways beyond this point. The method used depends entirely on the product and in most cases is a closely guarded secret. The usual procedure calls for numbers of fractional crystallizations of double nitrates requiring about one day for each step. These separations are increasingly difficult as atomic number increases; as a result only the first few members are made in commercial quantities.

Among the laboratory methods used to separate and purify these components are ion exchange of citrate complexes and liquid–liquid extraction using mineral acids and tributyl phosphate.

▶ **Uses Old and New**—Use of thorium dates back to the gaslight era. The discovery that colorless or low-illumination flames could cause a thorium oxide–cerium oxide mantle to incandesce started the rare earth industry. Ores contain about 6 to 20 times as much of the rare earths, hence uses were sought for the byproduct RE residue.

The thorium-free product (predominantly cerium, with other RE's in their natural ratios) can be used as is for a number of applications. It polishes optical glass rapidly,

† By a physicist's definition yttrium (atomic number 39) is not a rare earth, nor are lanthanum (No. 57) and cerium (No. 58). But because of the chemical similarities they are included in the loose definition of RE's.

believed to be due to a combination of abrasion, burnishing and solution effects.

Technical ceric hydrate is the starting material for cerium metal. Ceric ammonium nitrate is a good oxidizing agent, one use being the scavenging of spilled mercury fulminate in cartridge manufacture. Pure cerium nitrate (40 percent CeO_2) is used in gas mantle manufacture and as a reagent. Cerium helps in hot-working of steels. Cerium and thorium monosulphides are useful in refractories.

▶ **Further Treatment**—The RE mixture can be treated in a number of ways, depending on what end product composition is wanted. If yttrium and yttrium RE's are removed the remaining mixture, containing cerium and other RE's, is marketed as "technical rare earth salts." If cerium is separated, the remaining mixture of cerium-free RE's, still in their original ore ratio, is termed "didymium."

Yttrium-free RE's find a variety of uses. The hydrate mixture decolorizes ferric iron in glass. Textile waterproofing uses the acetate, anti-nausea pharmaceuticals use the oxalate (22 percent CeO_2). Oxide and fluoride are used in carbon-arc cores.‡ The chloride is used to make misch metal for cigarette lighter flints.

"Didymium" oxides are used for cleaner stainless steel, making lower grades suitable for auto trim. Didymium carbonate, oxide or oxalate can be used to color welders' glasses. Fluoride is used in carbon arc cores.

The didymium mixture can be separated into individual and pure RE compounds. Pure compounds of lanthanum, gadolinium, samarium, neodymium and praseodymium have interesting uses but are too costly right now to find wide application.

‡ Although sales to local movie houses have dropped, demand from drive-ins for larger carbons and from television studios has increased actual sales. The proposed 50 percent increase in TV stations could bring a fourfold increase.

Glidden Pioneers With First Latex Base Enamel

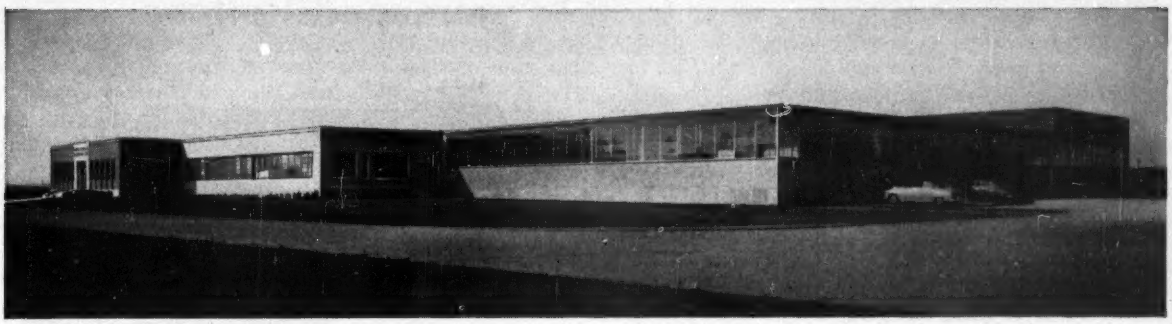
First latex emulsion base interior enamel ever developed commercially will be marketed next spring by Glidden Co. of Cleveland.

The new latex base enamel will be produced in a full range of colors from deep tones to pale pastels.

(*News continued on page 127*)

GOULD OPENS 21ST PLANT

TO MEET INDUSTRIAL BATTERY DEMAND



Front and side views of Gould's new Kankakee, Ill., plant

GOULD'S NEW KANKAKEE PLANT which went into production on November 10 is the 21st Gould plant in the United States and Canada. Devoted entirely to the manufacture of storage batteries for industry, it gives Gould the additional capacity necessary to meet the increased demand for Gould batteries in all parts of the country. Thanks to these new facilities, Gould customers can expect even faster service than before.

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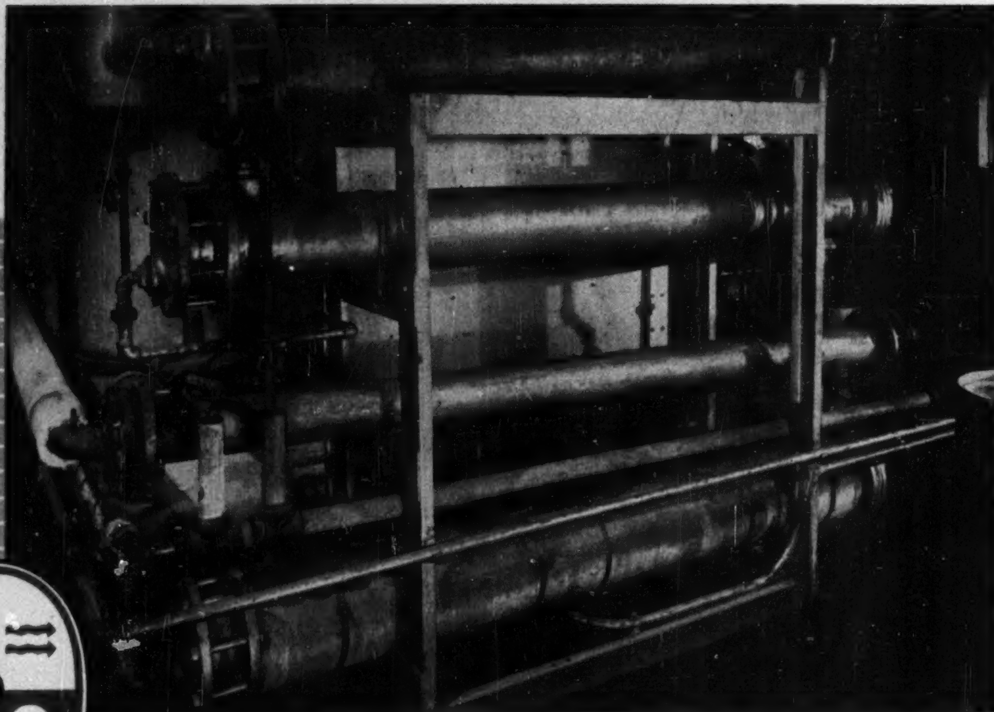

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Standard Design or built to your specifications

B & G *Hydro-Flo* Heat Exchangers are made in so wide a capacity and utility range that many requirements can be satisfied with standard units. If, however, special designs or materials are necessary, B & G equipment can be built to your specifications. The B & G engineering staff is always ready to assist in every way possible.

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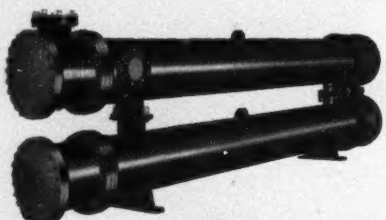
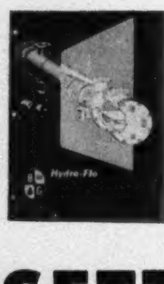


Two single pass, channel head B & G Heat Exchangers for series operation.

High pressure B & G Molasses Heater with fixed tube sheets and expansion joint design.

B&G Hydro-Flo shell-and-tube heat exchangers are available in the following types:

Straight and "U" Bend Tube Heat Exchangers • Fuel Oil Preheaters • Tank Suction Heaters • Aftercoolers • Gas Coolers • Water Heaters • Refrigeration Condensers and Evaporators.



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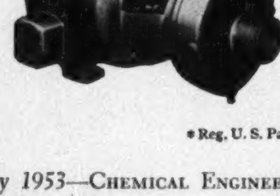

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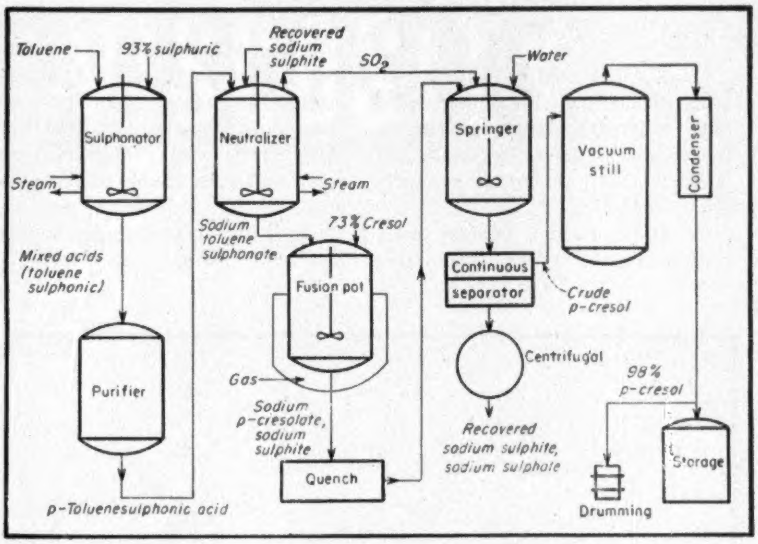


REVAMPED PROCESS for making para-cresol uses Na_2SO_3 instead of Na_2CO_3

Getting Set for Competition

Cost-cutting improvements in synthetic para-cresol process will help Sherwin-Williams protect its position, soon to be threatened by Hercules.

Sherwin-Williams, at present the nation's only producer of synthetic para-cresol, is streamlining its Chicago operations in an obvious effort to maintain its leading position in the field. Competition will soon be coming when Hercules Powder Co. brings in its new $8-million plant next year.

However, both SW and Hercules should find enough customers around to buy their respective outputs. At one time para-cresol went primarily into dye manufacture; today para has caught the tail of the high-flying antioxidant kite. Right now most para-cresol goes into trisubstituted anti-oxidants; 2,6-ditertiary butyl para-cresol—Shell and Koppers—and 2,2-methylene bis-(4-methyl, 6-tertiary butyl) phenol—American Cyanamid.

▶ **Process Improvements**—Among the improvements on Sherwin-Williams program are replacement of:

• Soda ash with byproduct sodium sulphite as the neutralizing agent of para-toluene sulphonic acid.

• Sulphuric acid with SO_2 for springing para-cresol from the sodium salt. The SO_2 will come from the sulphite-using neutralizing reaction.

• Its batch decanter with a continuous separator for parting the sodium sulphite-sulphate water layer from the para-cresol oil layer.

• Manual controls with automatic controls for governing raw materials into the sulphonator and regulating flow and pH in the springer.

As a result of these changes, SW expects to make two big savings:

In materials—by eliminating the consumption of purchased soda ash and reducing the amount of sulphuric acid needed.

In labor—the continuous separator and automatic controls will minimize operator attention.

▶ **Just Like Phenol**—Reuse of SO_2 and sulphite is long-standing practice in making synthetic phenol from benzene by the sulphonation process. Actually the SW para-cresol process is based pretty much on phenol technology—with one important exception.

That exception, and key to Sherwin-Williams' operations, is the separation of the isomers of toluene sulphonic acid to get a pure para. The company won't tell how this step works, is capitalizing while it can on its exclusive know-how.

Hercules' new process will resemble another phenol process. Dehydrogenation of monocyclic terpenes from turpentine will give para-cymene, which is then oxidized to para-cresol. The parallel phenol process oxidizes cumene (isopropyl benzene) to get pl nol and acetone.

▶ **High Purity Counts**—Makers of para-cresol from coke oven mixed cresols simply can't turn out a product of competitive purity. Distilled from coke-oven oil, cresol will run 60 percent meta, 40 percent para. After purification, it may run 80-85 percent para. SW's synthetic, on the other hand, runs over 98 percent para.

The high purity commands a premium price—around 50¢ per lb.—as against the 15¢ range for mixed cresols.

Who's Doing What

Chief producer Sherwin-Williams, who makes the purest para-cresol, is now completing a 50 percent expansion program started November 1951. SW's production, before expansion, was rated by market men between 900,000 and 2 million pounds annually.

This past June, Hydrocarbon Chemicals started to make an 87 percent para. It says it is now turning out 10,000 lb. per day of this mixed cresol.

Hercules enters the scene in 1953. See story.

However, Koppers, who was rumored to have a process for making synthetic para, says it does not plan to make any at this time.

Five, Three, Two

In 1950, five companies—Reilly Tar & Chemical, Republic Creosoting, Sherwin-Williams, Heyden and Allied (Barrett Division)—were producing para. In 1951, only three were in business—Reilly, SW and Barrett.

Since then, Barrett has dropped out of the field. Possibly they were getting too much meta isomer in its output. Anyway Barrett says it can get back in harness at any time.

Torrance Refinery Getting New Catalytic Reformer

A new thermofor catalytic reformer will be erected by Bechtel Corp. at the Torrance, Calif., refinery of General Petroleum Corp. Construction starts next May, and the unit should be completed by July 1954.

To cost $10 million, the new ther-

mofor catalytic reformer, with a capacity of 1,900 bbl. a day, will produce blending stock for making high-octane gasoline. It will also make products for petrochemical use.

Sulphuric Plant at Refinery Helps Combat Air Pollution

A sulphuric acid plant will be built by Consolidated Chemical Industries Inc. next to the Baytown, Tex., refinery of Humble Oil & Refining Co. As feed stock, this plant will use hydrogen sulphide recovered during processing of crude and also acid sludges from refining operations. Part of the plant should be operating within eight months, and all of it a year from now.

The new plant will go far to minimize atmospheric pollution at Baytown. Since the end of World War II, Humble has spent about $4 million in efforts to reduce air and water pollution. These efforts have already resulted in a much cleaner water effluent. Many measures have likewise been adopted at the Baytown refinery to reduce air pollution.

In the last five years alone, these measures have involved a capital outlay of about $3 million. But practical methods for handling such wastes are not completely known so more experimental work is required to get results.

The new sulphuric plant, which will utilize recovered hydrogen sulphide and acid sludges, represents the outcome of part of this work in which Humble has been assisted by Stanford Research Institute, where a technical group has significantly contributed toward abatement of atmospheric pollution in the Los Angeles area.

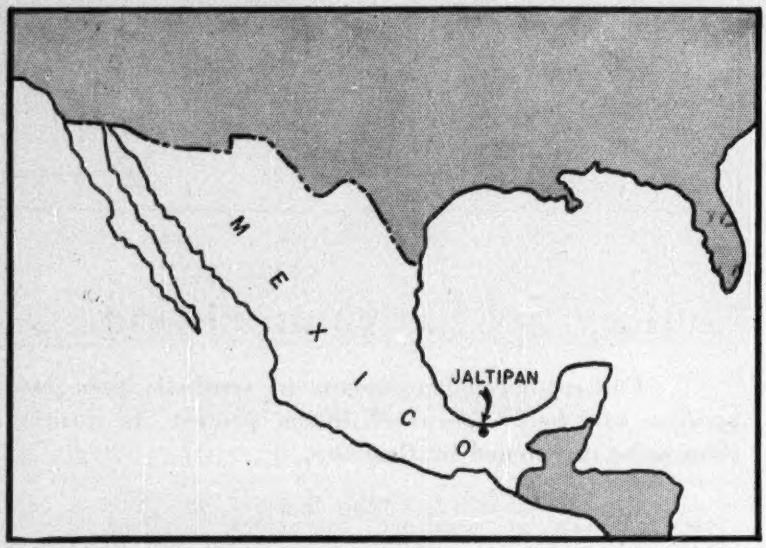
New Extraction Process Improves Soybean Meal

Central Soya Co., Inc., of Fort Wayne, Ind., has developed a new solvent extraction process for soybeans that produces an improved meal. The improvement apparently involves cooking to remove solvent rapidly and cause explosion of cell walls.

The new process literally explodes the cellular structure inside each soybean flake, freeing the protein for more ready digestion. At the same time an even film of moisture is provided around each flake and throughout each individual cell that comprises the flake. This moisture protects and improves the nutritional value of the protein.

Meal is light gold in color, has no bitter uncooked or burnt overcooked taste. It has 100 percent more vitamin B_1 (thiamin) than other meals, and essential amino acids that are more readily available.

While it doesn't contain more methionine or cystine than other meals, feed tests show chicks gain 6 to 8 percent faster on 4 to 6 percent less feed than those fed hexane-extracted toasted meal, and 34 percent faster on 13 percent less feed than those getting expeller meal. Fifty percent more water-soluble protein is retained because of protective action in toasting. Similar gains on less feed are reported for swine.



Frasch Heads South

First Frasch process sulphur plant outside the United States will be built in Mexico by Pan American Sulphur Co. at a cost of $5 million. Construction starts in February next year on the plant at Jaltipan in Southern Vera Cruz on the Isthmus of Tehuantepec, and it should be completed by August 1954.

When it starts operating, the plant, with an annual capacity between 300,000 and 600,000 long tons, will provide Mexico with sulphur for its growing industry. It will also help to alleviate the shortage of sulphur that has plagued world industry since World War II.

This shortage has been a drain on present Frasch plants in Louisiana and Texas, source of about 90 percent of the world's sulphur. However, the shortage has been eased somewhat by recent discoveries of deposits along the Gulf Coast.

The plant will produce 3.3 million gallons of superheated water daily to mine the sulphur by the Frasch process. The water will be forced into the domes to melt the sulphur before it is pumped to the surface for drying and ultimate use.

Running through the area is the Chacalapa River, 20 ft. wide and 2 ft. deep. An alternate water source, seven miles south of the plant site, is the Coatzacoalcos River, which can be reached by pipeline.

Fuel can be transported by pipeline, truck or railway tank car from the Pemex refinery at Minatitlan, only 16 mi. east of the new sulphur plant. The Pemex refinery has a daily capacity of 28,000 bbl. of crude. A natural gas fuel supply is also nearby in the Saline Basin area east of Puerto Mexico.

Labor, until now engaged primarily in agriculture, is plentiful in the area. Jaltipan has a population of 7,300. Other neighboring towns are Puerto

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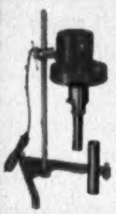
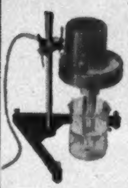


UL ADAPTER

When attached to LV models of the Brookfield Viscometer, the Brookfield UL Adapter, consisting essentially of a cylindrical spindle mounted symmetrically within a concentric tube, provides amplifying effects which make possible measurements to within .2 millipoises in the ultra-low viscosity range of .2 to 10 centipoises.

HELIPATH STAND

When used in conjunction with a suitable Brookfield Viscometer fitted with a special bar-type spindle, the Brookfield Helipath Stand lowers the rotating spindle through the test material, making possible the testing and study of highly plastic materials such as grease, putty, shaving cream, gelatin, shortening, etc.



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Designed to provide firm, easily-leveled support for a Brookfield Viscometer when used either by itself or equipped with a UL Adapter, the three-point screw-leveled base and adjustable elevation clamp of the Brookfield Leveling Stand insure fast set-ups and trouble-free determinations.

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Mexico with 25,000, and Minatitlan and Acayucan, each with 15,000. The plant will be built and manned almost completely by Mexicans.

The plant will be located on concessions totaling 22,000 acres on and around the Jaltipan salt dome. With only 40 percent of the Jaltipan dome explored, Pan American decided that reserves already appraised justified a plant.

Jaltipan dome has a fascinating history. El Aguila, the predecessor of Royal Dutch Shell in Mexico, in exploring for oil shortly after the Spindletop boom opened salt dome possibilities, reported sulphur showings. Two sulphur concessions were taken by Engineer Manuel Urquidi and General Alfredo Breceda, both Mexican citizens, in 1942. Later these concessions were assigned to the American Sulphur Co., the efforts of which, suffering from a lack of proper financing, were unsuccessful. It was in 1947 that American's obligations to the Mexican government were taken over by the Gulf Sulphur Co. de Mexico, S.A., the Mexican operating subsidiary formed in May of that year by Pan American. Perry Allen, a U.S. citizen who has practiced law over 20 years in Mexico, heads Gulf Sulphur.

Late in 1947 the Pan American Sulphur Co., through its subsidiary, began exploration that has so far cost more than $1 million, all financed by Pan American. When it was first suspected that two relatively small domes were actually one large dome, Pan American increased its original holding of 3,000 acres by acquiring 19,000 acres through new concessions in March 1951. Exploration soon confirmed that the Potrerillos and Jaltipan structures were actually one tremendous salt dome.

Pan American is a Delaware corporation with headquarters in Dallas, Tex., and was organized about five years ago by a group of independent oil men turned sulphur wildcatters. J. R. Parten of Houston is president.

Financing arrangements for the construction of the new sulphur plant in Mexico have been completed. The United States Export-Import Bank has loaned Pan American $3,664,000, payable at 5 percent interest over eight years. In addition, an offering of equity stock, to be underwritten by Kuhn, Loeb & Co. and Carl M. Loeb, Rhoades & Co., both of New York,

will be made to Pan American stockholders. This stock offering will yield about $3 million.

So far, Gulf Sulphur Co. de Mexico, the operating company with headquarters in Mexico City, has invested over $1 million in exploratory holes, purchase of concessions and equipment, and other improvements. The company will go forward with prospecting of the unexplored 60 percent of the Jaltipan dome area. At the same time that plant construction gets started, most of the 80 core holes already drilled will be cased and turned into producing wells.

Mexico has first call on sulphur produced by Pan American; Mexican needs must be met before Pan American can export sulphur. At present, Mexico annually produces 38,000 tons of sulphur. Total Mexican demand is 62,500 tons a year. The added sulphur from the new plant, therefore, will obviously benefit Mexico's growing industry.

President Parten of Pan American thinks the new plant will help to ease the sulphur pinch in the U. S. At present, he points out, there is an annual shortage of about 1 million tons in the world's sulphur supply. This has hampered expansion of chemical plants in Latin America. By supplying Mexico and other countries, Pan American will lift part of the export burden from the United States, freeing more Gulf Coast sulphur to meet climbing U. S. demand.

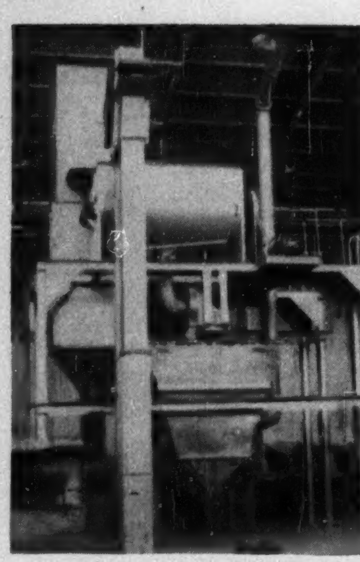
Archer-Daniels-Midland Cuts Price of Chlorophyllins

Price of commercial chlorophyllins has been cut sharply by Archer-Daniels-Midland Co. of Minneapolis, Minn.

Donald G. Carpenter, manager of ADM's Chlorophyll Division, says sodium and potassium copper chlorophyllins, used in most commercial products, have been cut to $60 a lb., figured on the basis of 100 percent purity. During the last year, the price has been from $75 to $85 a lb.

This price reduction applies to all chlorophyllins, in lots of 25 lb. or more, including shipments covered by existing long-range contracts.

ADM, a major processor of agricultural raw materials, entered the chlorophyll field last August on a broad scale, encompassing research, commercial development and production engineering. *(News Continued)*



Toxaphene Blending Grows Fast

Within five years some 85 firms have set up facilities to blend toxaphene-base insecticides.

The mixing and formulating of pesticides is now big business—and pretty much a specialized business, too. Toxaphene is a shining example.

Made commercially* for only about five years, toxaphene will soon hit the 100-million-pound-per-year class. And within the past five years some 85 manufacturers have set up facilities for blending toxaphene-base insecticides. Their total output will soon approach 175 million pounds annually.

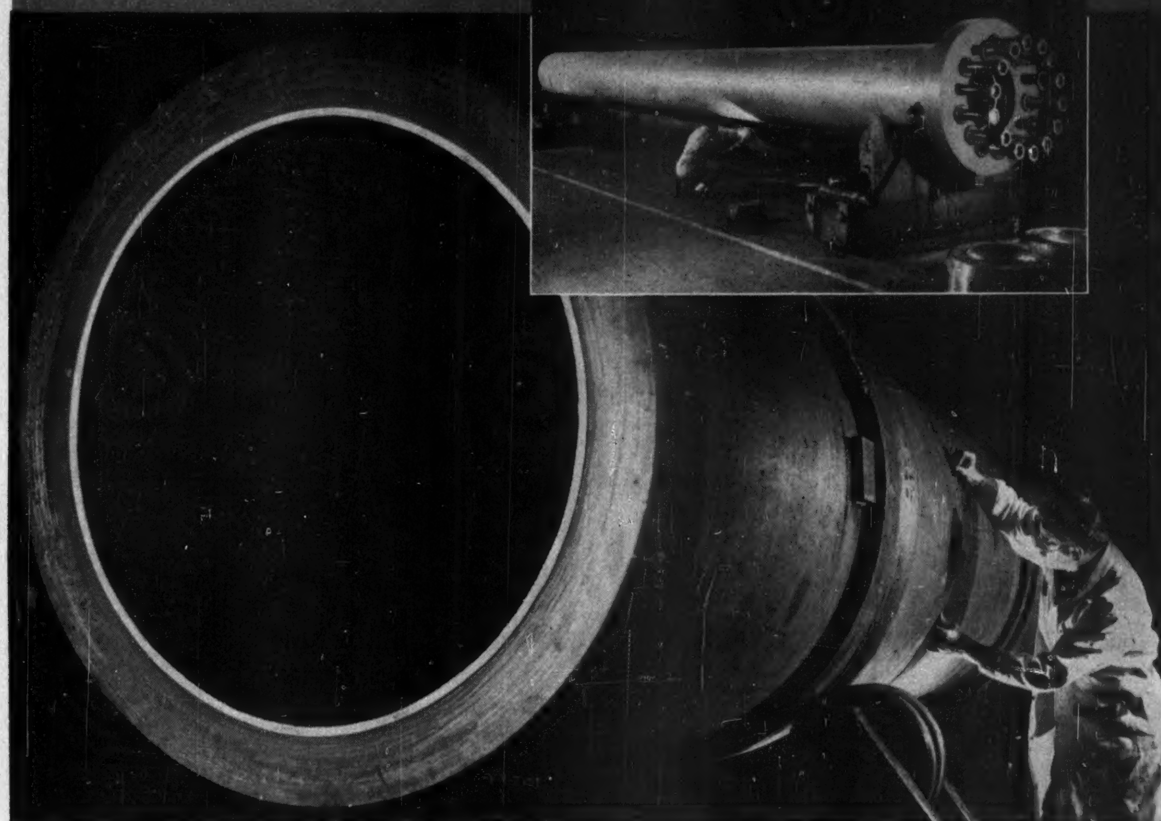
▶ **DDT Sparked It**—The finishing of pesticides now requires more engineering skill and better designed equipment than when the arsenicals, copper compounds and a few other inorganic dusts and sprays made up the bulk of the market.

It all started less than a decade ago when DDT and other new organics sparked what's sometimes referred to as "the revolution in agricultural chemicals."

One of the latest—and most modern—pesticide finishing plants is the large unit of Sanidad Agricola Mexicana, S. A., in Mexico. Raymond M. Cochran, an American chemical engineer, designed the unit; he is now plant manager. *(Continued)*

* By Hercules Powder Co. at Brunswick, Ga., and Hattiesburg, Miss.

MULTI-LAYER vessel for ammonia synthesis process. Length: 25 feet. ID: 40 inches. Wall thickness: 4½ inches. Weight: 100,000 pounds. Designed for 4,000 psi. operating pressure.



One of the shell courses for this multi-layer vessel. The end view shows the ½" thick inner cylinder of stainless steel, with the thinner steel plate wrappings around it scarfed for welding.

A. O. Smith MULTI-LAYER process gives chemical industry safe vessels for

Nitrogen Expansion Program

Many full scale vessels have been tested to destruction to prove the safety features of Multi-layer construction.

The high pressures of 4,000 to 15,000 psi, needed in the ammonia and urea synthesis process are completely met by the patented A. O. Smith multi-layer process.

As the name implies, multi-layer vessels are built up from concentric layers of relatively thin steel plates progressively wrapped, tightened and welded together around a pressure-tight cylinder. This means that vessel walls can be built up to the thickness demanded by the pressures required for the process. In the remote event of run-away overload, fragmentation of vessel walls is practically impossible due to the nature of multi-layer construction.

Automatically Vented—Only the inner cylinder of a multi-layer vessel need be pressure tight. The outer layers are provided with vent holes. In applications involving hydrogenation, venting prevents embrittling attack on the load-bearing layers.

Besides complete safety, you get these added features with multi-layer vessels.

BETTER DELIVERIES because multi-layer construction uses more readily obtainable thin steel plates.

CORROSION IS NO PROBLEM: Only the inner cylinder need be made of the specified alloy for the corrosion service. This saves expensive critical materials because the load bearing portion of the vessel wall—not in contact with corrodents—is manufactured of more economical steel plate.

NO SIZE OR WEIGHT LIMITATIONS. No compromises need be made in size or weight since restrictions imposed by ingot size or forming techniques do not apply to multi-layer construction.

CONSULT WITH A. O. SMITH ON YOUR HIGH-PRESSURE PROBLEMS.

A.O.Smith

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San Francisco 4 • Seattle 1 • Tulsa 3
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Licensee in Canada: John Inglis Co., Ltd.

Research and Engineering Building

▶**Solid is First Melted**—The Sanidad plant receives technical-grade toxaphene in galvanized steel drums that hold 250 lb. of the yellow, waxy solid. The metal container is peeled off manually.

The 250-lb. chunk of toxaphene is then cut into 8-in.-thick slices by a "guillotine" designed by Cochran.

Solid cake is held under a knife by a metal collar. As hydraulic pressure (about 350 psi.) is applied, the blades cut through the cake. This slicing increases the surface area so that the toxaphene can be melted faster. Toxaphene is insoluble in water, but dissolves in organic solvents.

Disks of toxaphene fall into a steam-jacketed glass-lined kettle held at 175 deg. F. About 6-8 percent by weight of straight-run kerosene (or a kerosene-xylene mixture) is added. The toxaphene both melts and dissolves in the agitated kettle, but the solvent is added primarily as a viscosity depressant. The mixture is pumped to an aluminum holding tank as fast as the toxaphene melts.

Liquid toxaphene, slightly diluted with solvent, can be processed into a liquid concentrate or a dust.

▶**Making the Solution**—Liquid concentrate now goes to the solution department; this consists of three interconnected mixing tanks and a bottling machine.

Solvent (usually kerosene) is measured in with a regular gasoline pump. The liquids are mixed by pumping through the three tanks; the final concentrate (40, 60 or 80 percent toxaphene) is drawn from the last tank and packaged in glass jugs or steel drums lined with a baked phenolic resin.

Sometimes DDT is added in the mix tank; the final concentrate then usually consists of 40 percent toxaphene, 20 percent DDT and 40 percent solvent. Before use by the cotton grower, the final concentrate is mixed with water in an emulsion for spraying.

▶**Making the Dust**—When dust is to be made a simple valve shutoff system sends the toxaphene-solvent melt from the dissolving kettle to two glass-lined tanks. There it is diluted to 40 percent strength in the same way as for liquid concentrates. Temperature is held at 175 deg. F.

It is then pumped through a 2-in. steam-jacketed bronze pipe to the

DORRCO DOINGS IN 1952

The outstanding event in '52 has been the landslide election of General Eisenhower, with Congress Republican by a very small plurality. A year ago I stated "Millions of us here today are thrilled by the hope that we can vote for a really great man, one like our first President, a great General, but above all an able and very wise patriot. No one believes that he would leave his present duties unless he felt that as President he could better serve his country and the world. It is inspiring to realize that he certainly can count on our strongest leaders to help build his team." Now 33 million voters, who gave him the greatest job in the world, must be ready to work as unselfishly for our country and the world as we expect him to do. America has taken heart at the promise of leadership based on unquestioned integrity of mind and character—and I feel all parts of the free world will do likewise.

* * *

RESEARCH AND DEVELOPMENT — We are continuing fundamental studies on classification and sedimentation as well as exploring further applications for fluidizing techniques. The Hydroscillator, first introduced at Tennessee Copper, is extending into other fields, notably low grade iron ore where the trend is towards sharper separations and cleaner sands. Several interesting developments in sewage treatment are currently under investigation. These include an improved digestion process and a method of accelerating secondary treatment.

KRAFT MILL RECAUSTICIZING — We recently conducted a survey in this field, visiting thirty pulp and paper mills, all of which employ the Dorr Continuous Recausticizing System. The main purpose of our visits was to discuss operational trends and to seek ideas for improvement. The general response was gratifyingly favorable and several changes have been adopted which will result in further increasing the efficiency of the Dorr System.

CONSULTING ENGINEERING — Our major design project for the year has been a large triple superphosphate plant for one of America's leading fertilizer producers. Other projects handled this year included such diversified operations as cyanide plants in the Middle East and Africa, a new zinc concentrator in the U. S., further developments in the chemical fertilizer field, and various hydro-metallurgical problems.

ABROAD — All our Associates in Europe and our recently formed Company in India have completed a very satisfactory year. Among our projects starting this year were a phosphoric acid plant in Greece and a kraft pulp mill in Austria. For the latter we supplied a Continuous Recausticizing System as well as a battery of Oliver Filters for the first continuous brown stock washing plant in Europe.

FLUOSOLIDS — The first commercial FluoSolids installation for roasting zinc concentrate went into operation last summer. It is producing SO_2 gas for sulfuric acid manufacture and a desulfurized zinc calcine for leaching prior to electrolytic zinc production. In addition to this installation, eight FluoSolids Reactors at paper mills in the U. S., Canada and Norway are either in operation or under construction to supply major portions of their SO_2 requirements for sulphite cooking liquor.

MUNICIPAL SANITATION — 1952 has been another active year for us in the fields of municipal water and sewage treatment. A very noticeable trend has been the mechanization of treatment plants serving smaller towns and municipalities. Here our complete small-scale plants are providing a high degree of sewage treatment for populations under 5,000.

INDUSTRIAL WATER TREATMENT — Accelerated by the demand for greater product quality control, industrial water treatment is rapidly approaching the municipal field both in size of installations and completeness of treatment. In the first ten months of 1952 we received orders for Dorr water pretreatment equipment which in the aggregate will handle almost 80 million gallons daily. These installations varied from a 600 gallon per hour ion-exchange system for a pharmaceutical manufacturer to a 26 MGD Dorrco Hydro-Treator for a new dissolving pulp mill.

MINE BACKFILL — The compact, highly efficient DorrClone is becoming increasingly popular for mine backfilling operations. One installation at Madsen Red Lake Gold Mines employs two stages to produce 120 tons per day of fill with a percolation rate of 4-6 in/hr. Key to the two-stage DorrClone flowsheet is flexibility. Any type of fill can be produced from practically any composition of mill tailings.

CANE SUGAR — In 1920, United Sugar Companies' Ingenio Los Mochis, one of Mexico's leading sugar producers, put into operation the first Dorr Continuous Cane Juice Clarifier to be ordered, following the initial demonstration at the Cuban American Sugar Company's Central Mercedita. In subsequent years, additional Dorr units were installed as the mill was expanded. In 1952 another Dorr Multifeed was ordered as part of Ingenio Los Mochis' current expansion program, and will go into operation for the 1953 crop. This is typical of the industry's continuing confidence in our sugar equipment.

* * *

We started the year in Cuba and enroute home saw an industrial revolution in Miami, engineered by MRA, whose principles we have seen working so effectively for industrial and international peace and understanding in many parts of the world today.

Crossing to Europe in May, we spent nearly a month in Spain. The incident of a Spanish Engineer working at Westport 26 years ago resulted in intimate contact with the warmest Spanish hospitality, giving us the feeling that we were privileged to come closer than most visitors to the real Spain. We left, greatly impressed by Spanish progress and the general happy philosophy of the people.

In Europe, visits to the ACHEMA Exhibit in Frankfurt and the Society of Chemical Industry Meeting in Aberdeen were most worthwhile, and the close cooperation and fine work of our Associates abroad brought renewed stimulation and admiration.

We are closing one of the best years in our history, with a strong conviction that with better understanding as a whole we can look forward to a gradually improving world.

We all join in sending to our friends everywhere greetings and good wishes.

John V. N. Dorr

Barry Place, Stamford, Conn.

DORRCO

dust-making department. (Non-ferrous metals must be used in handling the liquid as iron increases the breakdown of toxaphene, with liberation of HCl.)

Liquid toxaphene is sprayed (through a series of $\frac{3}{4}$-in. bronze nozzles) directly onto hot clay of the attapulgite group (Attaclay) that serves as a carrier. The material is agitated in a 2-ton ribbon mixer during this impregnation.

It then falls into a screw conveyor and is fed into a high-speed hammer mill. The product, now 93-95 percent through 325 mesh, goes into a vertical lift and to a 4-ton ribbon mixer driven by a 30-hp. motor at 42 rpm. It is now a 40 percent toxaphene dust concentrate.

Clay, sulphur and other materials can be added in the 4-ton mixer for different formulations. The dust passes through a non-sparking attrition mill to get a homogeneous mixture. It is bagged automatically into 5-ply, valve-type multiwall paper bags with one asphalt laminated layer.

CONVENTION CALENDAR

American Association for the Advancement of Science, annual meeting, St. Louis, December 26-31.

Plant Maintenance Conference, in conjunction with Plant Maintenance Show, Public Auditorium, Cleveland, January 19-22.

Society of Plastics Engineers, annual technical conference, Statler Hotel, Boston, January 21-23.

Commercial Chemical Development Association, Statler Hotel, Cleveland, January 22.

Association of Soap & Glycerine Producers, annual meeting, Waldorf-Astoria Hotel, New York, January 27-29.

American Pharmaceutical Manufacturers Association, eastern section meeting, Roosevelt Hotel, New York, February 2-4.

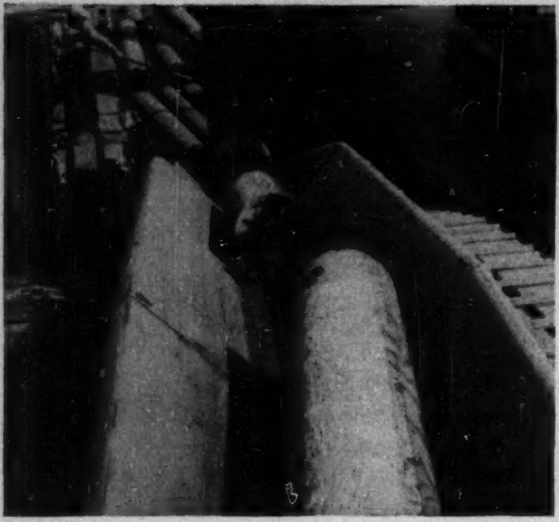
American Association of Textile Technologists, annual symposium, Statler Hotel, New York, February 3.

Manufacturing Chemists' Association, air pollution abatement conference, Statler Hotel, Detroit, February 26-27.

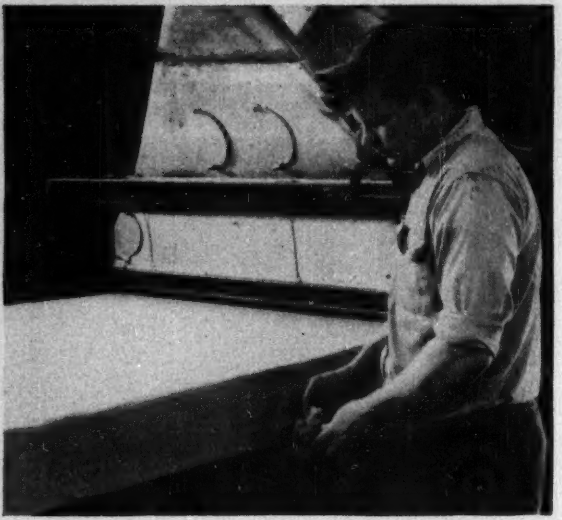
Drug, Chemical & Allied Trades Section, New York Board of Trade, annual dinner, Waldorf-Astoria Hotel, New York, March 5.

National Agricultural Chemicals Association, spring meeting, Jung Hotel, New Orleans, March 11-13.

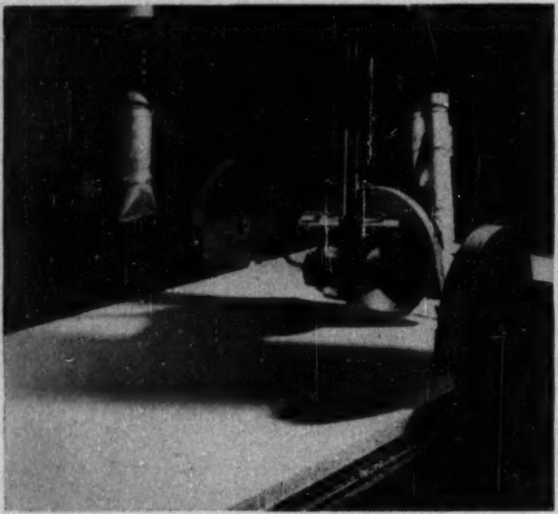
Southern Paint & Varnish Production Club, annual meeting, Buena Vista Hotel, Biloxi, Miss., March 18-21.



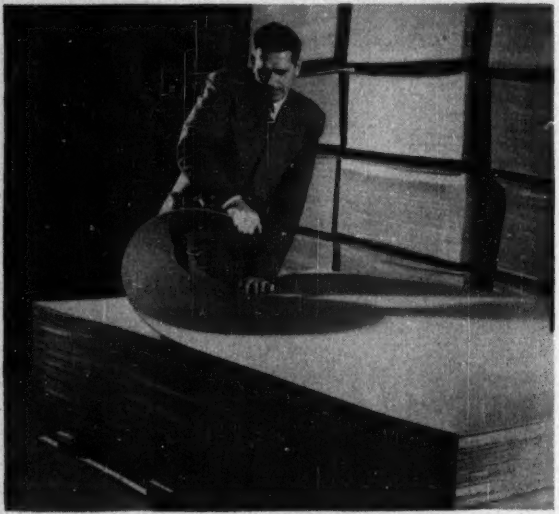
STARTING material: Log cores left over from peeling.



BLANKET of fibers before pressing is 6 to 10 in. thick.



TRAVELING SAW automatically cuts slabs of right length from 3-in. thick precompressed blanket of fibers.



FINISHED board has unusual flexibility, as demonstrated here by general manager H. W. McClary.

New Hardboard Process

Plywood waste is put to use in first commercialization of semi-dry process. Resin binder is the only liquid added; product is tough and flexible.

With its new high-strength hardboard now in full production, Anacortes Veneer, Inc., at Anacortes, Wash., is the first licensee of a new semi-dry process* perfected by the industry-backed Plywood Research Foundation.

* Covered by U. S. Patent Nos. 2,571,986 and 2,581,654 and corresponding foreign patents, with other patents pending.

From 1 to 3 percent of a thermosetting resin is the only liquid used in the process, in contrast to the 2,500 gal. of water used to produce 1,000 sq. ft. of ⅛-in. board by the wet process. With air as the conveying agent for the fibers instead of water, the semi-dry process doesn't need the expensive equipment and power to handle the immense volume of water required in the wet process, where the fiber is handled as a 4-percent slurry.

Anacortes is the sixth producer of hardboard on the West Coast—a new development in that area since the war. One of the largest worker-owned plywood firms in the Pacific Northwest, it is the first plywood plant in the country to get into commercial production of hardboard.

►**From Plywood Waste**—The new product, known as Armorbord, is made solely from solid old growth Douglas fir which accumulates in various forms in a plywood plant—such as centers remaining after the logs have been peeled and solid veneer trimmings

(Continued)


They Shed Splashes
Like Water Off a Duck's Back

CONSOLE panel automatically controls most of the process operations.

which cannot be used for plywood. The process at present does not use bark but can use other types of wood besides Douglas fir.

Anacortes' new board plant cost about $1 million. Present daily capacity is 90,000 sq. ft. of $\frac{1}{8}$-in. board, with expansion already under consideration. Made in 4-ft. by 8-ft. panels, Armorbord is light tan, with a hard, satiny surface.

▶ **How It's Made**—The raw material is chipped into small pieces averaging about $\frac{3}{8}$ in. square. (Storage bins at Anacortes can hold 1 million lb. of green chips, enough for one week's operation.) The chips are softened under steam at pressures of 20 to 50 psi. for 5 to 20 min., are then fed to a continuous cooker through which the chips are advanced by a series of adjustable paddles.

Wax size (about 1 to 3 percent) is added to the chips in the cooker.

The next step is grinding. Screw conveyors provide a steady continuous flow of chips to two mechanical grinders at temperatures of 275 to 300 deg. F. The chips emerge from the grinders as individual fibers and tiny wood fiber bundles with brushed-out ends.

Next the resin is mixed with the fibers in a continuous blender. The fibers are then fed to a specially designed felting machine. A high-speed rotor distributes them to the top of the felter chamber. The fibers fall upon a moving belt synchronized with

(Continued)

the output of the grinders. Some fibers lie flat, others stand on end.

▶ **Random Arrangement**—This non-directional pattern of the fibers is the main difference between board produced by the semi-dry process and standard wet processes. During pressing, the fibers are arched or bent over, forming myriads of microscopic interlocking trusses. This gives the product high impact resistance and flexibility.

As the mat emerges from the felter it is 6 to 10 in. thick, depending upon the thickness and physical properties desired in the finished board. A pre-compressor reduces the thickness to about 3 in. before the mat is cut to desired lengths by a traveling saw.

The hardboard press is conventional except for a greater daylight opening between plates. Mats are received on a wire-cloth conveyor. Curing takes 8 to 10 min. at 325 to 375 deg. F.; the individual fibers are permanently re-united in a thin, hard, homogeneous sheet.

The sheets are ejected from the press by means of the wire cloth which remains under the mat during pressing. The mat also facilitates venting of moisture. Moisture content of the board is brought up to 5 to 7 percent in a conventional tunnel humidifier.

▶ **Robot Plant**—Up to this point the entire process is automatic. The only hand labor involved is that of feeding the trim saws and systematic grading before packaging for shipment. Only 30 men are needed to turn out 2.5 million sq. ft. monthly.

Celanese Producing Acetic By New Process in Texas

An entirely new process is being used to produce acetic acid and acetic anhydride in the new $17 million petrochemical plant of Celanese Corp. of America at Pampa, Tex.

While acetic acid and acetic anhydride are the principal chemicals being made during the initial phase of operations, derivatives of these chemicals will eventually be produced. Units to produce the derivatives will be built as soon as work on the present facilities is completed.

The new plant likewise increases Celanese production capacity for methanol and acetone.

Celanese developed the new process for making acetic acid and acetic an-

hydride in its Clarkwood, Tex., petrochemical research center. Raw materials are liquefied petroleum gases from the Texas Panhandle, where the plant is located.

New Fertilizer Plant Will Use Nitric Acidulation

A new process will be employed by the Nitrogen Division of Allied Chemical & Dye Corp. to produce a high-analysis complete fertilizer in a $5 million plant to be built at South Point, Ohio. Nitric acidulation will be used in the process.

Construction of the new plant starts this fall. Allied expects it to be completed by the summer of 1953.

In the new process, developed by Allied after four years of research, ground phosphate rock is continuously mixed with nitric acid and a small amount of sulphuric acid. Next, the material is reacted with anhydrous ammonia to neutralize any acids present and to increase the content of plant-food nitrogen. Potash salts are added, and the product is granulated to uniformly sized particles that are free flowing and easily handled in fertilizer distributing equipment.

The high plant-food content of the product will be obtained through substituting nitric acid for a large part of the sulphuric acid normally used to make complete fertilizers. This will result in annual savings of up to 88,000 tons per year of 100 percent sulphuric acid needed for other uses.

Containing all three essential fertilizer elements, Allied's product will have 36 percent plant food, made up of 12 percent each of nitrogen, available phosphoric acid and potash. It will help to meet fertilizer requirements of farmers in the Midwest.

New Allied Plant To Make Ethylene Derivatives

Construction of a $5 million plant in Texas for production of organics has been started by Allied Chemical & Dye Corp. First to be built for Allied's Organic Department, the plant will occupy a 650-acre site bordering the Sabine River at Orange.

Allied will manufacture ethylene oxide, ethylene glycol, diethylene glycol and triethylene glycol at the new Orange plant. No other plant of Allied now makes these chemicals.

Goodrich Increasing Output Of Sodium Polyacrylate

As a result of increasing demands for soil conditioners, B. F. Goodrich Chemical Co. has expanded plant facilities for volume production of sodium polyacrylate, a basic ingredient for making conditioners.

By early 1953 sufficient quantities of sodium polyacrylate will be available. No shortage, such as occurred when soil conditioners were first introduced, is foreseen.

Manufacturers of soil conditioners and commercial packagers will get sodium polyacrylate directly from Goodrich in water solution or as powder or flake. None will be sold to consumers.

While sodium polyacrylate has hitherto been used in paint manufacture, sizing and rubber latex compounding, its use in soil conditioners increased demand, causing a temporary shortage.

Du Pont Halts Sale of Fermentation Ethanol

Du Pont will discontinue the sale of ethyl alcohol at the end of this year.

When additional synthetic alcohol capacity, now under way, gets into production around the middle of 1953, there will be sufficient capacity to meet the requirements of the entire country. Since 1932 Du Pont has produced ethyl alcohol at Deepwater, N. J., by the fermentation process.

Du Pont will meet all contractual obligations until the end of the year, and will continue to supply its regular customers for a longer period if necessary until they can arrange to get their alcohol elsewhere.

Discontinuing the sale of ethyl alcohol in no way affects Du Pont's manufacture and sale of methyl alcohol.

Electron Microscope Detects Sources of Air Pollution

The electron microscope is proving an important tool in tracking down sources of atmospheric pollution, according to Dr. W. C. McCrone of Armour Research Foundation at Illinois Institute of Technology in Chicago. For the first time, the micro-

scope makes it possible to pinpoint sources of smoke.

"Of course," McCrone says, "we have been able to detect carbon in smoke samples by conventional chemical tests, but magnification of a specimen up to 50,000 times its actual size with the electron microscope enables us to identify its source—whether it is from an industrial smokestack or a trash fire in an incinerator.

"By the same method, we also have been able to identify fibrous materials found in air pollution, such as paper, cloth, and feathers."

In addition to its use in determining the sources of air pollution, McCrone is using the electron microscope to analyze high explosives, metals, crystal structures, particle sizes and dispersion of particles.

International's Researchers Push South's Use of Timber

Research with the goal of developing pulp and paper products from southern trees will get added impetus now that International Paper Co. has opened its new $400,000 laboratory in Mobile, Ala. The laboratory is one of the most modern and completely equipped in the South.

Full pilot-plant operations can be carried out in equipment at the new laboratory, according to Erling Riis, vice president and general manager of International's Southern Kraft Division.

International has made great strides in its research on utilization of wood from southern trees. Southern Kraft developed the first mass production of Fourdrinier kraft linerboard from southern pine. Other achievements: the first successful bleaching process for both kraft paper and board in the South and the development of the first process for making dissolving pulp by the kraft process from southern hardwood.

Youngstown Adding Ovens To Increase Coke Output

First new coke making facilities to be installed by Youngstown Sheet & Tube Co. at Youngstown, Ohio, in more than 30 years will produce 450,000 tons of coke per year. No new byproduct facilities will be added to present installations since the coke gas is needed for other purposes.

While the company has disclosed

WHAT'S HAPPENING, *cont. . .*

no figure, it's estimated the complete plant will cost about $10 million. It will consist of a battery of 76 new ovens on a site near the company's present Campbell works.

Youngstown Sheet & Tube now operates three batteries, a total of 306 ovens with a capacity of 1,350,000 tons of coke annually, at its Campbell works and another battery of 84 ovens with a capacity of 370,000 tons a year at its nearby Brier Hill works. By-product facilities find use for part of the coke gas from each of these installations.

With an eye on the future, Youngstown Sheet & Tube is also sponsoring, together with others, the recently formed Hydro Coal Transportation Co., a utility, which has acquired land over which the new Ohio Turnpike will pass. When the turnpike is constructed next summer, Hydro will ask for an underpass beneath the turnpike and on the land it has acquired. This will be for possible future use in transporting coal by pipeline from a dock on the Ohio River in the East Liverpool area to industrial users of coal in Youngstown.

New Sodium Chlorate Plant For Oldbury in Mississippi

Construction has started on the new $3.5 million sodium chlorate plant of Oldbury Electro-Chemical Co. near Columbus, Miss. Sodium chlorate from the new plant will begin to reach the market late in 1953. Other chlorate compounds may be manufactured later.

Five miles south of Columbus on the Tombigbee River, the plant will have access to Louisiana's deposits of salt, prime material for sodium chlorate production.

Sodium chlorate is used increasingly in agriculture and industry, the most immediately important uses being as a weed eradicator and cotton defoliating agent. Other uses are in the metallurgical, textile, and pulp and paper industries.

Urea: New urea plant of Sumitomo Chemical Co. is now in operation at Niihama in Japan. The plant was engineered and designed by Chemical Construction Corp., and Chemico will soon expand it, tripling its capacity. The Japanese plant uses a new high yield process devel-

oped by Chemico to produce both plastic and fertilizer-grade urea.

Dyestuffs: Southern Dyestuff Corp. has begun a $250,000 expansion at its plant near Charlotte, N. C. The program includes two new buildings and a research and development center.

Sulphur: A fourth rich deposit of sulphur that can be mined by the Frasch process has been discovered by Gulf Sulphur Corp. on its Mexican holdings. Gulf Sulphur has already cored 52 ft. of rich sulphur formation in this new well, is still drilling through sulphur. This newest discovery will add thousands of tons to present proved reserves of more than 600,000 long tons.

Titanium: The country's largest titanium plant and the world's first for fully integrated production from ore to finished ingot is now producing four tons of metal a day. It's the Henderson, Nev., plant of titanium Metals Corp. of America and it's still expanding. Target capacity: 10 tons a day.

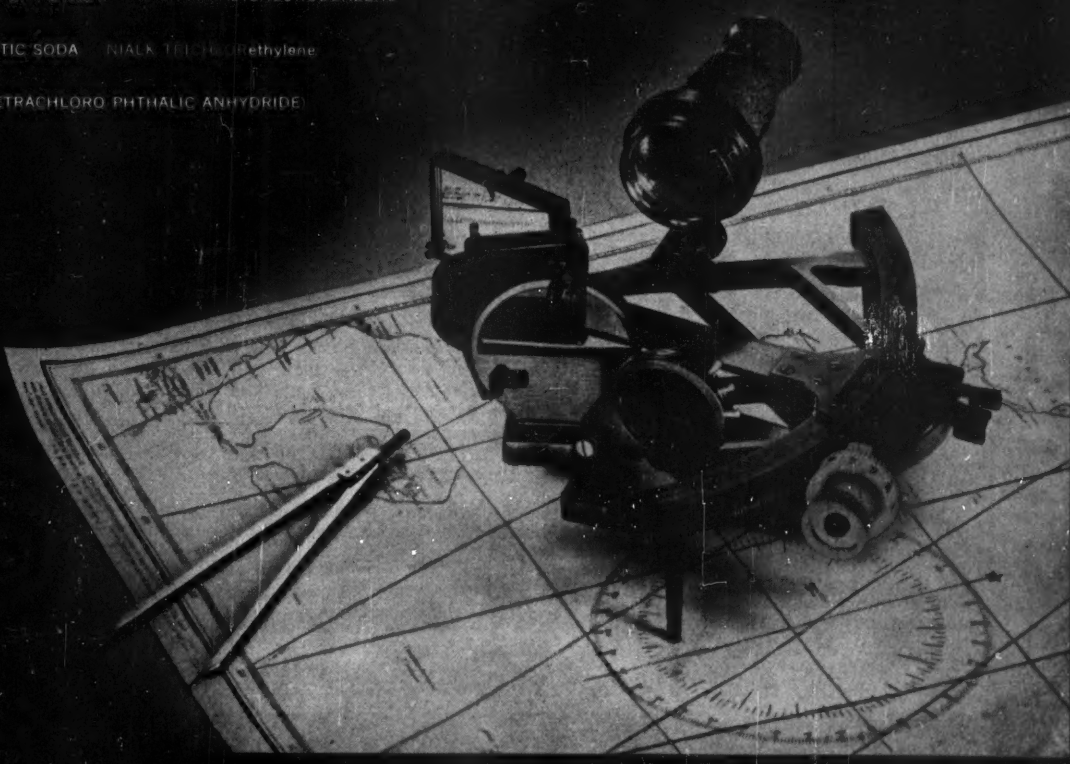
Chlorine-Caustic: Western Chemicals Ltd. is building a $3 million caustic soda and chlorine plant at Duvernay, 70 mi. east of Edmonton, Alberta, on the North Saskatchewan River. The 20-ton-a-day plant is expected to be operating by next summer.

Bleach: Farm & Industrial Chemical Co. of Atlanta recently opened its new $150,000 bleach plant located five miles south of Dalton, Ga. At peak, the plant will daily produce 16,000 gal. of liquid bleach.

Phenolsulphonates: New facilities for production of sodium and ammonium phenolsulphonates are just about completed at Burlington, Iowa, by Bonewitz Laboratories, Inc. The two chemicals will be offered at present market prices.

Plastic: Dewey & Almy Chemical Co. of Cambridge, Mass., has come up with a new high-styrene copolymer for use in shoe soles, floor tile and wire and cable insulation.

Pro & Con, turn to page 152



Pro and Con

New Series on Costs

Sir:

About six months ago I purchased a copy of your reprint booklet "Data & Methods on Cost Estimation" which I have been using almost constantly ever since. The information is so useful to me that I'd like to see you continue the good work in *Chemical Engineering* . . . maybe one cost estimation article in each issue.

JACK B. GOODMAN

Chemical Engineer
Wilmington, Del.

Sir:

Have just read the article "Blower and Fan Costs" by Rudolph Denzler in your October issue (p. 130). I want to congratulate you and Mr. Denzler for this article . . . which is loaded to the gills with practical, useful, up-to-date data. It is one of the best things you've published in recent years.

KARL SCHINDLER

Consulting Chemical Engineer
Atlanta, Ga.

Sir:

Your article "Blower and Fan Costs" in October was worth its weight in gold to me . . . it couldn't have been more timely.

As process engineer at one of my company's big plants, I had just been assigned to do a similar job. I figure that the data Mr. Denzler accumulated and presented in his article saved me close to 115 hr. of work in writing letters, collecting information and making tedious calculations.

You may be interested to learn that my supervisor was impressed with the speed and thoroughness of the job (thanks to Mr. Denzler's help). He practically promised me a raise at the first of the year . . .!

NAME WITHHELD

Process Engineer
St. Louis, Mo.

Sir:

Over the past several years *Chemical Engineering* has published a large number of articles on equipment costs and methods of cost calculation.

These were quite helpful to me, and I would like to see more of them. They would be especially useful now, when most engineers are pressed for time . . . and have to carry a heavier work load in connection with the chemical industry's expansion program. Do you plan to publish more of them in the near future?

CHARLES L. SULLIVAN

Engineering Advisor
Chemical Processing Corp.
Newark, N. J.

▶ *In reply to these and the other requests we've had for more articles on cost estimation, the answer is "yes"—coming up!*

In addition to Mr. Denzler's article in October on blowers and fans, we already have similar manuscripts covering the cost aspects of heat exchangers, dust collectors and electric energy generation and distribution.

And all the feature articles in this issue are devoted to some aspect of cost estimating.

Besides, we're now beginning a series on the broader aspects of "engineering economics." We think you'll like it.—ED.

It's Your Sounding Board

With this issue, Pro & Con becomes a monthly feature of *Chemical Engineering* in this location. It takes the place of our former department, Readers' Views & Comments.

If you ask why we're making this change, here's the reason:

Chemical engineers are becoming bolder, more vocal in expressing their views, especially on controversial developments in their field. This trend has sharpened noticeably in recent years. And it is a trend that's reflected in the increasing number of letters we receive from our readers.

We think this is all to the good, and we encourage it. This Pro & Con department is being set up, in fact, to encourage it even more.

We welcome your letters, your pertinent views and comments on developments in the chemical process industries and in the chemical engineering profession. And we welcome, as in the past, your comments and constructive criticisms on the editorial material in *Chemical Engineering*.

Pro & Con is your sounding board—your medium for passing along your own ideas to some 37,500 engineers throughout the chemical process industries. Simply address the Editor, *Chemical Engineering*, 330 West 42nd St., New York 36, N. Y.

Thermo, Not Servo

Sir:

In your September issue, p. 180, we see that you have illustrated and described our newly-designed temperature controller. Unfortunately, you have referred to our firm name as Servo Electric Co. instead of Thermo Electric Co., Inc. of Fairlawn, N. J.

FRED LANGE

Fred Lange Associates, Inc.
New York, N. Y.

Goal: 100 Percent by 1955

Sir:

I am now preparing an analysis of industrial growth in the United States since 1942 . . . and I would like your help, if possible, on one phase of the chemical industry. . . .

Specifically, I would like to get the most recent figures on government-sponsored expansions in the various segments of the chemical industry and the most up-to-date figures on the values now in place.

I have seen so many figures (all different) that I wonder what the actual score is. . . .

K. V. DONALD

Industrial Analyst
Western Industrial Development Co.
Seattle, Wash.

▶ *Latest score, according to DPA itself, on expansions by tax write-off certificates:*

	Total Cost, Millions	In Place, Percent
Chlorine and alkalis	$293	64
Industrial inorganics	816	32
Industrial organics	609	48
Byproduct coke ovens	198	54
Synthetic fibers	172	45
Pharmaceuticals	63	94

The figures for value in place are estimated as of the first of October.—ED.

Two Shades of Green

Sir:

I've read your recent editorials and comments on the chlorophyll (or chlorophyllin) situation . . . I'll go much further and state that I believe a good half of the "miracle-working" properties of the stuff is pure bunk . . . deliberately promoted by a handful of publicity specialists and advertising sharpsters.

In addition, from my own recent experience with chlorophyll extraction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processes now in use, I'd place them in the third-rate class of technical achievements. If these producers have something (as they claim they do), why aren't they able to show some evidence of engineering achievement worthy of the chemical industry . . . instead of jealously guarding so-called secrets that usually aren't worth guarding? Some of these "modern" chlorophyll processes are engineering-wise 20 years behind the times. . . .

NAME WITHHELD

Chemical Engineer
Milwaukee, Wis.

► *Like some of the chlorophyll ads, opinion on this whole subject seems to be running amok.*

In contrast to these remarks by Reader X (name withheld by request), one irate visitor recently raised merry hell with us because we made "unfair" remarks—as he put it—about some of the unusual new uses suggested for the chlorophyllins.—ED.

What's Propaganda?

Sir:

I read your recent article "Five Things You May Not Know About Soil Conditioners" in your August issue (p. 311). I want to tell you that I consider it as propaganda, nothing but low-down propaganda. . . .

NAME WITHHELD

Works Chemist
Brooklyn, N. Y.

► *To some people, propaganda is the other fellow's side of the picture.*

We certainly do not look upon the story we published as "low down" propaganda: otherwise it never would have seen print in this magazine. We consider it as a commendable effort by Monsanto to clear up a bit the muddled picture on soil conditioners: What they are, what they can do, what they can't do, how useful they are when properly made and used.

If this be propaganda, what about the lurid ads and claims that have been showered on the American public? We stick by our guns—with plenty of heat.—ED.

Not Really Sad

Sir:

Elliot Schrier's article on the problems of the Intermountain area (Oct., p. 356) seems to have a note of sadness to it. Why?

The difficulties of the Intermountain area are not difficult at all. It will not be many years before there is a complete network of oil and gas lines over the area to supply fuel. Highway trucking is already forcing

the railroads to see reason in better freight rates. As the materials of the area are developed more manufacturing will be done on the spot for a growing population.

Let's see what the experts said about that area in the last century:

In 1819 Secretary of War John Calhoun sent 20 scientists to explore and report on that very region. On their return, Dr. Edwin James, the geologist with the expedition, reported that the area was worthless, and that "this region may for long remain the unmolested haunt of the native hunter, the bison, and the jackal."

Thomas Say of the Academy of Natural Sciences, Philadelphia, a member of the expedition, reported: "The country within five hundred miles of the mountains is destitute of timber and miserably poor, thus furnishing us with an excellent frontier in that direction which is totally unfit for tillage of civilized man and which may for ages afford an asylum to the cruelly persecuted Indian."

Calhoun was not satisfied with the reports and sent a second expedition in 1823 composed of the most eminent scientists under command of Major Stephen Long, an army engineer at West Point. They explored the vast territory between the Red River, the Mississippi, and the Canadian Border. The report said that the region "is almost wholly unfit for cultivation," and that it could "serve as a barrier to prevent too great an extension of our population westward."

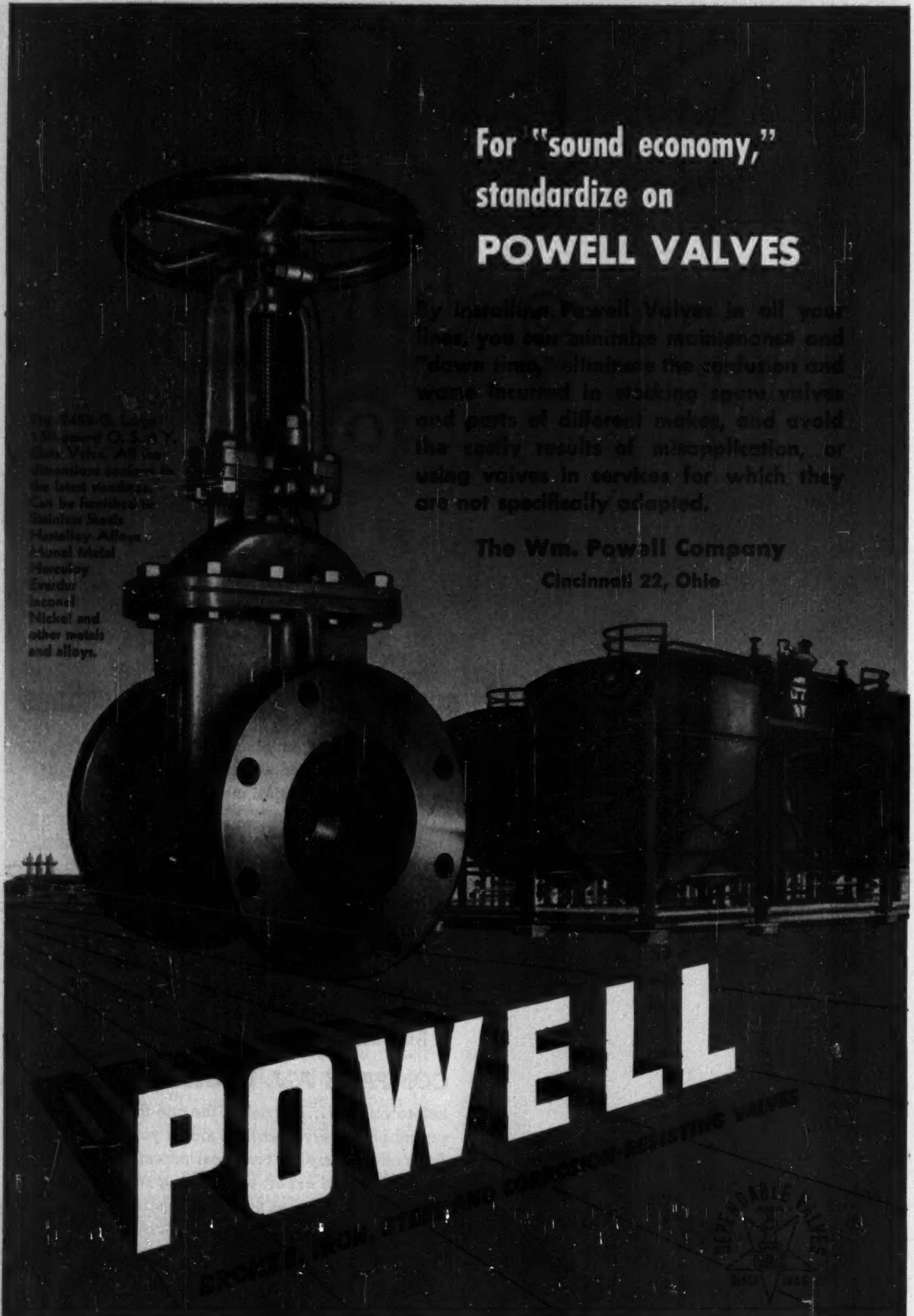
The Mormons and the poor and ignorant laborers who went westward apparently did not read the reports of the eminent scientists. They did not know that the region was worthless, so they built up ten great states there. Maybe some who don't know about present difficulties will stumble along and build up the area further!

George S. Brady
Industrial Materials Service
Washington 15, D. C.

► *Western Editor Schrier may be a bit surprised (as we were) to learn about that "note of sadness" in his report on the problems of our Intermountain West.*

But Col. Brady is right in his comments about the Mormons and other staunch souls who went right ahead and built up the western third of this nation. And to this day most Westerners have a healthy streak of that same rugged independence and disregard for precedent.

But is that alone enough to industrialize an area almost three times the size of all New England.—Ed.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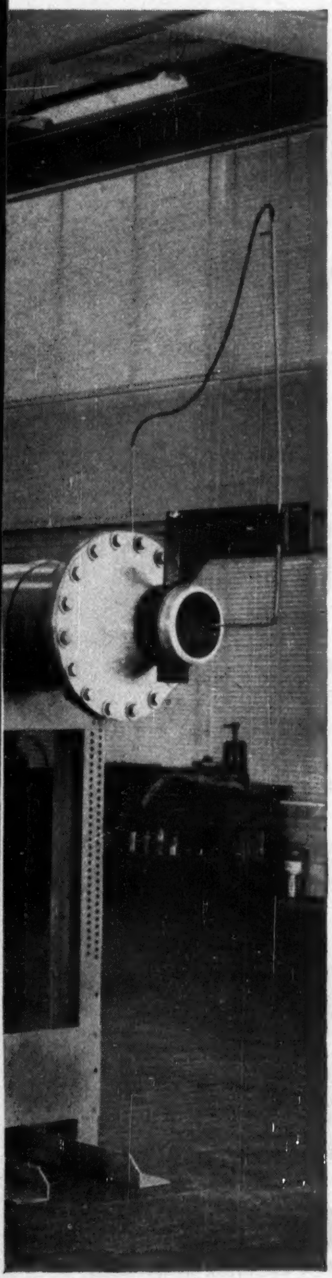

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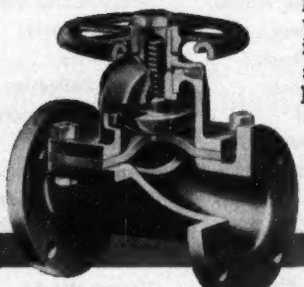

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- Rubber Plants
- Sewage Plants
- Smelters and Mines
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The new Nordstrom Corrosion-Resistant Valve Bulletin V-217 will make it easy for you to fit the right valve to each service. Write for a copy, Rockwell Manufacturing Company, Pittsburgh 8, Pa., or ask your Nordstrom sales engineer.

JANUARY 1953 Chemical Engineering

Why the Emphasis Today on Costs?

Never before have costs been so vital to chemical engineers. So we start off 1953 with eight feature articles on how to estimate and control them.

The entire feature section of this month's issue of Chemical Engineering deals with the theme of costs—equipment costs, engineering costs, estimating methods, economic selection of materials and equipment, cost control, cost terminology.

Why put such emphasis on costs in a technical publication? There are at least two good reasons.

In the first place, our readers have asked for it. Whether their technical specialty is distillation or instrumentation, plastics or fertilizers, they all find a common meeting ground in the subject of costs.

We have seen ample evidence of this interest ever since our pioneer venture into this field in May 1947. A frequent comment turned up in our continuous monthly reader surveys goes something like this: "I like your series of articles on costs. Keep up the good work."

There's another, more fundamental reason for emphasizing costs. It's based on the role which the engineer plays in our American free enterprise system.

This thought was brought out recently by Dr. Sydney Steele, director of planning for Atlas Powder Co. Dr. Steele contrasted the fluctuating value of the dollar with the constant values of other units used by engineers. Tracing the history of the dollar over the past 40 years, he pointed out that if the present trend continues, the consumer's dollar in 1990 will be worth only 10 cents on the 1939 dollar.

Dr. Steele challenged chemical engineers to apply their best efforts in the fight against inflation. As he put it, "The best way in which engineers can do their part to preserve and raise material standards of living is to think in terms of basic costs and to work for their reduction."

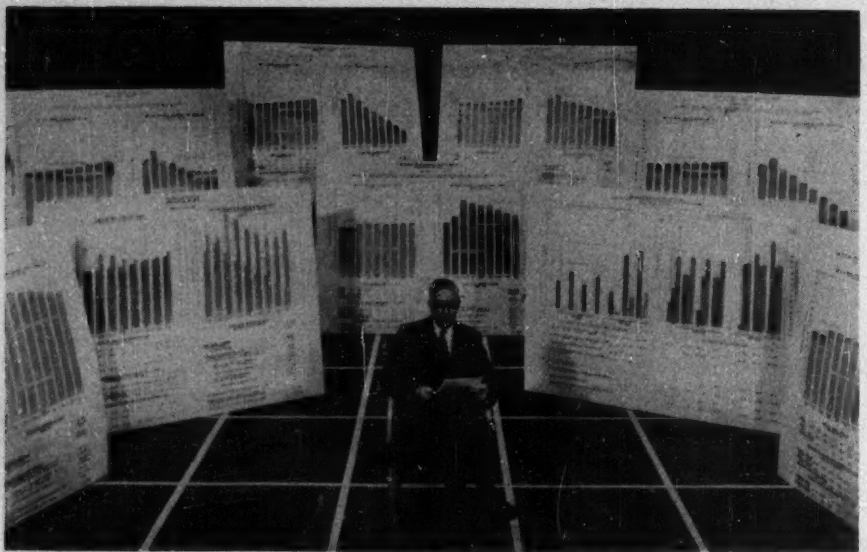
Along this same line, the Paley report, issued last summer, warns of the threat of slowly rising costs of basic materials as the richer and more abundant sources approach depletion. Regardless of fluctuations in the value of the dollar, the threat facing all of us is a gradual rise in the real costs of materials, with consequent lowering of our standard of living.

Dr. Steele cited an example of the contribution of the engineer in combating this trend. Improved designs of power generating stations have reduced the consumption of coal (or equivalent oil and gas) from nearly 3 lb. per kwh. in 1921 to a little over 1 lb. in 1951.

We in the chemical industry can be proud of the industry's ability to meet such challenges, but we must emphasize even more strongly the need "to think in terms of basic costs and to work for their reduction."

That's why we think it appropriate to lead off our Vol. 60 with the eight articles that follow. More will appear in succeeding issues.

John R. Callaham



WHETHER hurried or detailed, cost estimates are all-important tools for making decisions.*

How to Estimate Costs in a Hurry

Here are some suggested short-cuts which make it easy to evaluate the economics of a proposed operation at the earliest possible stage. You can learn a lot from a study of corporate financial data.

HENRY E. WESSEL

Under normal economic conditions, chemical plants exist for one purpose only—to make a profit. From the inception of a project as a vague idea to its successful culmination as a plant operating at rated capacity, the major yardstick for action all along the way is profitability—predicted and attained. Even after the plant has been in operation, the value of suggested improvements is measured by the extent to which they might increase profitability. Ingenious though a suggested device or a line of research investigation may appear, the decision as to whether further work will be done should rely heavily on the estimated economics, or profitability.

Research directors are seldom at a loss for new ideas or suggestions. Instead, they must frequently decide which ones of ten or a hundred suggestions are worthy of further investigation. Along with other useful tools used in making such a decision, an estimate of the "economics" involved is essential.[11] A comparison of the elements of the profitability picture for an existing manufacturing operation will sharply outline the areas in which successful research will pay real dividends.

This article develops the relative significance of each item in the overall chemical process profitability picture. From such considerations rough criteria for short-cut estimating at the very early stages of the development of a project may be inferred. This is a region of cost estimation not very greatly developed, partly because any broad generalizations are valueless unless used with considerable judgment.

H. E. WESSEL *is senior chemical engineer with Midwest Research Institute, Kansas City, Mo. Cost-conscious CE readers will remember his correlation of operating labor data published last July.*

SELLING PRICE AND VOLUME

Generally, estimates of selling price and volume are not the province of the chemical engineer, but rather of the market research and sales departments.[2] The process engineer should understand, however, why these values are apt to cover a range and not be pin-pointed, particularly in the early stages of the project. One chemical executive has pointed out that estimates of annual sales dollars have been the point of least certainty in many project evaluations.[18]

The volume estimate may be based upon the premise of capturing a reasonable percentage of the market for the chemical in question, or on displacing a reasonable percentage of another chemical from a market for which the proposed new product is an acceptable, usually less expensive, substitute. In this latter connection, remember that demand for many chemicals stems from the utility of certain active groups within the molecule,

* Here's how cost estimates and market analyses went into General Petroleum Corp.'s recent decision to build a $35 million refinery at Ferndale, Wash. R. L. Minckler, company president, is surrounded by results of a two-year economic study.

while the main structure may or may not add a synergistic action. Very few chemicals are specific, and usually a product has to compete with other products. For example, copper 8-quinolinolate at $4.25 per lb. successfully competes with copper naphthenate at $0.25 per lb. in mildew-proofing uses because, among other reasons, a proportionately smaller amount of the former is needed.

As a result of the present high cost of manufacturing facilities and high income tax rates, the selling price of many chemical products must be in the range of twice the manufacturing cost in order to obtain a 10 percent return (after income taxes) on the total fixed and working capital. The 1951 average selling price for acyclic organics was $0.084 per lb. and for cyclic organics $0.21 per lb.[8]

CAPITAL REQUIREMENTS

Fixed Capital (machinery and equipment, buildings, auxiliaries)—Methods for detailed estimation of capital requirements for these items are available in the literature.[1, 5, 6, 10] For preliminary estimates where less accuracy is required, a value of plant investment per annual ton of product capacity can be used.[4, 7, 8] A few of these values are shown in Table I, with a comparison drawn between 1943-44[15] and 1951 values to point up the increase in plant costs in recent years and the bearing this has on profitability. Should a preliminary capital cost be desired for a process not listed in the references, it might be estimated by comparison of processes with a product which is listed, step by step, if necessary, and with suitable corrections (see examples below).

An alternate, less accurate method, for estimation of fixed capital requirements is from the turnover ratio, which is the ratio of annual sales dollars to the original cost of the plant (Table I).[8]

Examination of the financial data of some of the larger chemical companies (see Table II) shows turnover ratios varying from about 0.6 to 2.0 for strictly chemical companies, with a further correlation with the type of business. Dow, Spencer, and Union Carbide, strong in large-volume petrochemicals, show turnover ratios of 0.8 to 1.1. Pennsalt, Hooker, and Mathieson are strong in heavy inorganics and chlor-alkalis; their turnover ratios are 0.66 to 1.2. Monsanto and Du Pont are strong in volume organic intermediates with turnover ratios of 1.35 and 1.42. A still better correlation is apparent when corrections are made for the proportion of newer high-cost plants (see the percentage of plant depreciated, Table II).

Note that when costs for advertising, special taxes, and expenses for intensive selling and distribution become important, the turnover ratio rises to 3.0 (Abbott Labs), 4.5 (Schenley), and 5.4 (General Mills). When the product is manufactured from basic raw materials in very large volumes, such as ammonia, methanol, or gasoline, the ratio is substantially under 1.0. Turnover ratio averaged 1.48 for 1951 for 100 selected chemical process companies.[8] Omitting some very large values for special cases, and noting an average of around 35 per-

Table I—Investments and Turnover Ratios for Complete New Plants†

	Plant Cost $ Per Annual Ton 1943–44	Plant Cost $ Per Annual Ton 1951	Turnover Ratio 1951
Inorganic Chemicals			
Ammonia ex natural gas	130	180	0.45
Carbon bisulphide	54	93	1.37
Electrolytic chlorine, caustic soda	—	172	0.45
Soda ash	25*	67	0.32
Sulphuric acid ex sulphur	15	17	1.14
Carbon black	30*	100	1.40
Calcium carbide	44	78	1.55
Sulphur ex H_2S	7	12	1.50
Nitric acid by direct oxidation	—	150	1.30
Plastics and Fibers			
Methyl methacrylate	430*	740	1.10
Phenolic resin	49*	48	8.30
Neoprene	910	1,200	0.58
Nylon, complete	—	3,500	1.0
Viscose rayon	—	440	1.89
Organic Chemicals			
Acrylonitrile ex cyanohydrin	140*	160	4.65
Synthetic glycerine	—	500	1.41
Allyl alcohol	1,580*	1,800	0.33
Benzaldehyde by chlorination	480*	900	0.99
Ethylene (6¢ per lb.)	85*	120	1.0
Methyl isobutyl ketone	33*	55	4.36
Phthalic anhydride ex naphthalene	190*	340	1.24
Acetic acid by alcohol oxidation	134*	240	0.69
Isooctyl alcohol	—	600	0.84
Alcohol ex grain	62	140	1.01
Trichlorethylene ex acetylene	—	110	1.96
Methyl chloride ex methanol	—	56	3.84
Urea ex ammonia	—	44	2.36
Styrene	300	540	0.61

† Data from References 3, 9 and 15, and private sources.
* May be low since cost was for addition to existing plant.

Table II—How Turnover Ratio Varies With Type of Business

	Turnover Ratio Original Plant Cost Basis	Turnover Ratio Depreciated Plant Value Basis	% Plant and Equipment Increase 1949–1951 (Current Dollars)	% Net Sales Increase 1939–1951 (Both in 1939 Dollars)	% Depreciation of Plant & Equipment (1951)
Schenley	4.5	6.8	123	754	34
Distillers—Seagram	11.8	20.3	116	321	42
Commercial Solvents	1.58	2.95	110	192	46
Charles Pfizer	2.15	3.30	158	667	35
Abbott Labs	3.00	3.90	146	245	23
Merck	1.84	2.33	100	173	21
Tenn. Prod. & Chem	2.20	3.35	110	409	34
Dow	0.88	1.20	144	474	27
Union Carbide & Carbon	1.08	1.94	124	148	44
Du Pont	1.42	3.15	124	135	54
Monsanto	1.35	2.1	130	188	36
General Mills	5.40	9.65	107	160	44
Goodyear	2.83	7.6	119	151	63
St. Regis Paper	1.24	1.8	116	493	30
Minnesota Mining	2.16	3.2	148	312	33
Hooker	1.20	1.92	135	320	36
Penn Salt	0.96	1.42	119	227	44
Diamond Alkali	0.97	1.55	118	190	38
Mathieson	0.66	1.04	140	273	36
Victor	1.12	1.50	148	178	25
International Minerals	1.08	1.59	110	157	33
Spencer	0.90	1.08	170	...	17
Catalin Corp	5.2	7.1	141	239	26
Durez	1.9	2.8	120	300	44
Phillips Petroleum	0.62	1.08	123	146	42
Average of 100 selected chemical process companies	1.48				

Table III—Elements of Working Capital

		Percentage of Annual Sales Dollar
Raw materials inventory	One month supply at cost (Use 50% of manufacturing cost or 25% of selling price)	2
Materials in process inventory	One week at manufacturing cost	1
Product inventory	One month at manufacturing cost	4
Accounts receivable	One month at selling price	8
Available cash to meet current expenses of wages, raw materials, utilities, supplies	One month at manufacturing cost	4
Total		19

Table IV—1951 Net Working Capital Ratios for Various Companies

	Annual % of Sales Dollar
Average, 100 chemical process companies	24.6
Commercial Solvents	38.5
Merck	30.2
Union Carbide & Carbon	25.0
Du Pont	27.0
Monsanto	23.5
Hooker	20.5
Spencer	34.3
Phillips Petroleum	14.2

cent of plant and equipment already fully depreciated, the average turnover ratio is slightly under 1.0 for companies with a preponderance of newer plants, e.g., 0.88 for Dow.

Using these guides, turnover ratios can be estimated for proposed operations with sufficient accuracy for some preliminary project evaluations. Kiddoo's turnover ratios[8] are based on spot prices, but he indicates that they will yield order-of-magnitude results. A plant cost can be estimated from the turnover ratio with accuracy which may permit the choice of proposed new products or processes to be narrowed down to a few which are actually competitive.

Working capital requirements are seldom estimated with the precision used to estimate the capital cost for equipment items. Kinckiner[20] points out the effect of working capital on the over-all profitability pictures, noting that it can be extremely important in the case of high-unit-value products.

The elements of working capital requirements, together with standard values used for estimation[1, 5, 8] are outlined in Table III. Note that accounts receivable and cash are relatively inflexible; they are set by the financial policy of the company and the type of business. The values for inventories are variable and probably somewhat smaller for very large-scale operations, particularly where storage is limited. Additional storage might be required elsewhere in such cases, however, making price adjustments necessary and bringing the inventory values back to the average.

Net working capital ratios for chemical process companies are listed in Table IV.[8] Note that a higher ratio is carried by companies producing products of seasonal demand, which require large inventories for appreciable periods of time.

MANUFACTURING COST ESTIMATE

An excellent method for the detailed estimation of this cost was published by Dybdal.[8] Some rough generalizations, however, may have value in preliminary estimation for profitability.

First, let us consider that the present combination of high plant cost and high Federal income taxes requires a minimum selling price for a chemical product approximating twice the manufacturing cost in many cases. If we make some generalizations—$1 plant cost per $1 annual sales; working capital at 20 percent of annual sales; selling, research and administrative expenses at 10 percent of annual sales; and income taxes at 70 percent—the ratio of selling price to manufacturing cost is almost exactly two to one at 10 percent return after income taxes on fixed and working capital. Further indication of this two-to-one ratio is evident from a list of estimated manufacturing cost distribution for selected processes, Table V.

Some other generalizations can be drawn from Table V. If the cost of raw materials, steam, water, fuel and power are grouped together, with but few exceptions the total of these costs amounts to between 50 and 85 percent of the total manufacturing cost. The high-volume, low-cost products such as chlorine-caustic, tonnage oxygen, soda ash and synthetic hydrochloric acid are grouped on the low end. These are also processes with low turnover ratios (0.5 and less). For these processes, depreciation becomes a major item in manufacturing cost, amounting to 25 to 45 percent.

Operating labor, supervision and associated charges form a small part of the total manufacturing cost,[24] varying from about 5 to 20 percent for the processes listed in Table V. These

Table V—Cost Distribution as Percentage of Manufacturing Cost

	Formaldehyde ex Methane[1]	Monsanto "X" (Liquid-Solid)[2]	Ammonia[7] (As Part of Nitrate or Urea, Steam Reforming)	$HNO_3 + NH_4NO_3$	Urea	Pharmaceutical	Tonnage Oxygen[3]	Alcohol ex Molasses	Electrolytic Chlorine + Caustic[4]	Phenol via Sulphonation[5]	Aniline[5]	Soda Ash, Ammonia-Soda Process	Platforming + Udex[6]	Gasoline Refining (Complete)[5]
Raw materials	28	75	12	68[7]	60[7]	83	.....	75	9	76	82	36		80
Steam, water, fuel	3	} 5	21	3	7	0.5	13	6	18	2.5	6	18	86	{ 3
Power	16						40			1.5		1		
Subtotal	47	80	33	71	67	83.5	53	81	27	80	88	54	86	83
Labor, salaries	23	5	13	6	10	10	2	13	11	8	8	13	6	5
Maintenance	...	3	4	2	2.5	2	8	2	18	6	...	3	2	4
Miscellaneous	30[8]	5	6	5	3.5	2.5	.....	...	...	...	4	...	.....	
Taxes, depreciation	...	7	44	16	17	2	37	4	44	6	...	...	4	8
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Production rate, tons/day	...	7.5	200	300	100	1	1,000	100	50 + 56.4	50	50	300	1,500[9]	7,500[10]
Selling price, ¢/lb	...	...	4.0	3.5	5.5	200	.....	...	2.7(ea.)	20	18	1.3	1.8 (avg.)	1.4 (avg.)
Manufacturing cost, ¢/lb	...	...	2.5	2.0	3.0	120	1.8	...	2.0(ea.)	11	12	...	.....	1.1 (avg.)

[1] FIAT Report No. 1035. [2] See Reference (6). [3] Downs, C. R., *Chem. Eng.*, Aug. 1948, p. 115. [4] Wilson, A. J. P., *Chem. Eng.*, July 1951, p. 287. [5] "Chemical Engineering Flow Sheets," McGraw-Hill, 1944. [6] *Petr. Proc.*, 7, 839 (1952). [7] Ammonia at $80 per ton. [8] Includes amortization. [9] 10,000 bbl. per day. [10] 50,000 bbl. per day.

Table VI—Current Depreciation Allowances for Various Companies

Du Pont	7.8%	Monsanto	5.5%
Merck	6.7%	Victor	4.9%
Spencer	6.5%	Phillips	4.9%
Dow	5.9%	Mathieson	3.9%

Basis: Original plant cost.

costs also group around an average, depending upon the type of operation, of 5 to 8 percent for liquid or gaseous processes of large scale, about 10 percent for moderate-scale intermediates or pharmaceuticals involving liquids and solids, and up to 15 to 20 percent for products involving considerable solids handling, such as soda ash.

Maintenance usually varies from 5 to 15 percent of the plant cost on an annual basis, which corresponds to 2 to 8 percent of the manufacturing cost per unit. In the case of processes such as electrolytic chlorine, where the turnover ratio is low and the corrosion problem is severe, the maintenance cost may rise to 18 percent of the manufacturing cost.

The so-called indirect manufacturing costs are largely depreciation, local taxes, insurance on equipment and buildings, and general plant overhead. The estimated average rate of depreciation for individual equipment items is listed by the Bureau of Internal Revenue.[1] For estimation purposes, a value of 10 percent is frequently used for equipment items, although this is a higher average than the Bureau of Internal Revenue list would indicate. Current values for depreciation reserve allowances, on the basis of original plant cost, are shown in Table VI.[8]

Local taxes are often at 2 percent of the investment annually, and insurance at 1 percent, same basis. If these are taken at a turnover ratio of one and manufacturing cost equal to one-half selling price, taxes and insurance amount to about 6 percent of the total manufacturing cost.

The distribution of general plant overhead against individual products varies with the local plant accounting methods. Estimates of 50 to 75 percent of the operating and maintenance labor plus supervision have been used.[1,8] The trend toward more fringe benefits may bring this up to 100 percent in some cases.

The remaining indirect expenses are general administration, selling expense and research expense. These are estimated on the basis of sales at 2 percent, 3 to 10 percent, and 3 percent, respectively.[8] Another estimate places these at 1 to 2 percent, 5 to 15 percent, and 2.5 to 4 percent, respectively.[1] Knowing the company, these values can be pin-pointed with considerable accuracy. An average value of 10 percent for the total is indicated.[8]

RETURN ON INVESTMENT

We have discussed the relative size, hence, importance of the various items necessary to derive the return on investment before income taxes. The gross earnings, after deducting interest on debt financing and administrative, selling, and research expenses, are subject to Federal income taxes. Table VII lists the rate at which selected chemical companies were taxed in 1951.

Deduction of the proper amount of income taxes leaves the net profit from which the net return on total fixed and working capital may be computed. The 100 selected chemical process companies[8] had an average rate of return for 1951 of about 8 percent, based on net sales, and approximately the same on an invested capital basis. This group includes some low-tax-rate petroleum companies, so that the average return for straight chemical companies would be lower.

Dr. R. P. Soule discusses the relation between minimum accepted rate of return, type of operation projected, and the type and cost of capital available.[18] He points out that projects aimed at conservation of earning power get first priority in spite of the size of the return. He also points out that high-risk projects must show a rate of return high enough to include the penalty of a share of the cost of other previous unsuccessful high-risk projects and still produce a net gain to the stockholder.

Twenty representative chemical companies financed their 1951 expansions in plant and equipment as indicated in Table VIII.[8]

Table VII—Federal Income Tax Rates Paid in 1951 by Various Companies

	Per Cent of Profit Before Taxes
Average, 100 chemical process companies	52
Federal Trade Commission, chemical company average	Over 60
Texas Co	36*
Monsanto	62.5
Dow	62.5
Du Pont	62.5
Commercial Solvents	49.0
Merck	66.5
Hooker	66.0
Spencer	48.0
Tennessee Prod. & Chem	65.0

* Petroleum companies lower due to tax allowance for depletion of mineral reserves.

Table VIII—How Chemical Companies Financed Their Expansions

	1946-1951	1951
Debt capital	14%	6%
Preferred stock	16%	18%
Common stock	5%	8%
Retained earnings, change in depreciation reserve and in working capital	65%	68%

EXAMPLE I

The management of "X" Chemical Co. has decided that some of its captive chlorine production will be available next year and wishes a quick look at the profitability picture for the manufacture of methylene chloride. This product is a prime ingredient in solvent degreasers for which a rapidly enlarging market is predicted. Predictions of chlorine availability, plus an estimate of the possible market which "X" can capture, conservatively put the desired production rate in the range of 2,500 tons per year. Chlorination of methane is to be used, since the 2,150 tons of by-product HCl can be sold. At $220 per ton for methylene chloride and $100 per ton for HCl, 100 percent bases and freight allowance deducted, annual sales will be $765,000.

Chilton[4] gives plant cost data for carbon tetrachloride by chlorination of methane, which is taken to be analogous to the operation projected for methylene chloride. The plant cost is given as $88 per ton of carbon tetrachloride per year. Using $70, since the methylene chloride process is less complex than that for carbon tetrachloride, the plant cost is $175,000. With working capital at 20 percent of annual sales, the total capital is $328,000.

Yield data for carbon tetrachloride from methane is available in Faith *et al*;[7] 75 percent of theory is realized, the remaining chlorine going to other chlorohydrocarbons. Using this same value for methylene chloride, we find

(Continued on page 200)

WHEN MAKING COST ESTIMATES . . .

Watch Your Language

Catch phrases or colloquialisms can be confusing unless your audience knows what you mean. The authors define and relate the various terms used by engineers in economic analyses.

R. D. BEATTIE and J. E. VIVIAN

Information and ideas have little value unless they can be transmitted to those who apply them. In preconstruction cost analyses, the one making the analysis is seldom the one to execute the recommendations derived from the analysis. Consequently, the language and manner used to report the findings of cost analyses assume major importance.

In few areas of engineering are the variety of terms and the diversity of their significance so great. However, since cost analyses are usually prepared for internal consumption, it is important only that the use of the terms is consistent within the organization and that their meaning is clear.

This article discusses and defines some of the more common terms used in preconstruction cost analyses.

Engineers use the terms "cost analysis" or "cost data" to include not only actual costs, but the result of the comparison of cost and value. To determine how these data should be presented, it is worthwhile to consider their end use by management.

Management's job can be divided into two categories—to control current operations effectively and to plan and execute possible expansion of the organization. Both of these functions require adequate cost information of different varieties, and engineers are in a unique position to correlate and interpret the cost figures for management in the light of the potentialities and limitations of the technical processes.

For production analysis of current operations, most of the operating cost data is available from the accounting department, but in planning for expansion management requires preconstruction cost estimates for the various proposals to assess their relative merits (capital requirement and rate of return).

Thus, there are two distinct varieties of preconstruction cost estimation—plant cost and operating cost. In this area the engineering staff is responsible for assembling a wide diversity of information for reliable cost estimation and for transmitting it to management.

The operating picture can be presented in the form of an *estimated profit and loss (or income) statement*, while

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Estimated Income Statement

Product________
Estimated Sales Price________
Capacity________
Operating Rate________

Net Sales		____
Direct Production Costs	____	
Indirect Production Costs	____	
Fixed Production Costs	____	
Manufacturing Cost of Sales		(____)
Gross Margin		____
Selling Expense	____	
Research Expense	____	
Administrative Expense	____	
General Expenses		(____)
Income Before Taxes		____
Taxes on Income		(____)
Net Income		____

"This arrangement is a compromise of wide variations."

the cost of the plant can be presented in the form of an *estimated capital cost statement.* Both statements are required for a complete financial picture of a proposed project; various ratios derived from the two statements may be used by management as yardsticks to gage the financial attractiveness.

INCOME STATEMENTS

While a final income statement cannot be prepared without adequate knowledge of capital cost, preliminary evaluations may be made based on very rough estimates of capital cost. These will indicate whether a suggested project is worth considering in greater detail. Usually only a small percentage of the capital cost is reflected in the income statement anyway.

It should be remembered that an engineering estimate in its various degrees of detail costs money to prepare. Consequently, the estimating work should be subjected to continuous scrutiny. Unattractive projects can thus be discarded before doing an unwarranted amount of detailed work.

Shown here is one form of estimated income statement.

This arrangement is a compromise of wide variations and is designed to eliminate the ambiguities associated with some of the terms. Note that there are relatively few terms involved and, with a little thought, most items in the operating cost picture can be fitted into one of the categories indicated.

First item on the schedule is *net sales*. This is the dollar value of the expected monthly or yearly production of the plant, less any allowances in the form of contract discounts, bulk shipments and freight adjustments. This item is somethimes referred to as *receipts, net receipts* or *income from sales*.

The next item is *manufacturing cost of sales*, sometimes referred to simply as *cost of sales*. The former term seems to be preferable, since this item includes only those costs which are incurred at the plant site, being made up of production costs (direct and indirect) and certain fixed costs. Manufacturing cost of sales corresponds to the accountants' *cost of goods sold* which appears in many financial statements. In the estimation of this item, the engineer can be of particular assistance to management.

The difference between net sales and manufacturing cost of sales is referred to as *gross margin, gross income, gross profit* or *manufacturing profit*. There seems to be little choice among these terms, although gross margin seems to be preferred currently.

From gross margin certain *general expenses* are deducted. As indicated, these include *selling, research,* and *general administrative expense*. The last term seems to be a catch-all for various commercial expenses associated with the business.

The difference between gross margin and general expenses leaves a quantity which has a greater variety of names than the other items in cost statements. In order to avoid ambiguity, current practice tends toward a definite term like *income before taxes*, or even more completely, *income before taxes on income*.

The picture has been completed by including *taxes on income*, which is deducted from the income before taxes to get *net income*. Net income is also known by a variety of names, such as *income after taxes, income available for distribution, income available for dividends*, etc.

COST OF SALES

Most of the work in preparing an estimated income statement involves estimating the manufacturing cost of sales. It is desirable to have a standard form or check list for a guide. The particular form is a matter of choice, but the information included is generally the same.

Sometimes it is convenient to divide the items into three main categories—*direct production costs, indirect production costs,* and *fixed costs*. The distinction between direct and indirect production costs is frequently arbitrary, and in some cases it is desirable to use a single category of production costs. The sample schedule shows a number of items constituting manufacturing cost of sales.

Depreciation requires special comment. In operating a plant, the facilities are, in a sense, consumed in producing the product. While *maintenance* keeps the plant in running order, provision must be made for recovering the initial cost by the time it has served its useful life. Provision for this recovery by depreciation charges is as much a cost of manufacturing as any other item.

Estimated Manufacturing Cost of Sales

Product__________
Capacity__________
Operating Rate__________

Raw Materials........ ____
Labor........ ____
Utilities........ ____
Operating Supplies........ ____
Royalties........ ____
Maintenance........ ____

Direct Production Costs...... ____
Supervision........ ____
Indirect Payroll Expense........ ____
Plant Protection........ ____
Plant Office........ ____
General Plant Overhead........ ____
Control Laboratory........ ____
Packaging........ ____
Freight and Hauling........ ____

Indirect Production Costs.... ____
Depreciation........ ____
Property Taxes and Insurance.. ____

Fixed Production Costs...... ____

Manufacturing Cost of Sales... ____

"It is desirable to have a standard form or check list."

Depreciation is a difficult item to treat realistically because adequate information about new or proposed projects is seldom available. Except in unusual operating conditions, practice is to use rates allowable by the Bureau of Internal Revenue.

Obsolescence is an ever present hazard in chemical operations and may be considered as accelerated depreciation.

Some cost analyses include an item under fixed cost for *interest on capital investment*. This is not desirable, since proper handling depends entirely on the current financial activities of the company and tends only to confuse the estimate of manufacturing cost of sales. A satisfactory place to handle such charges is under general administrative expense where, if included as a specific item, its effect on the over-all cost picture can be readily asserted.

The use of an interest term at all in the estimated income statement will depend on the end use of the information. It is ambiguous to include interest on the capital as a cost and then to calculate rate of return based on net income.

CAPITAL COST STATEMENTS

Fortunately, there is less confusion of terms used in estimating the required capital for a proposed project. Many of the terms in the sample schedule are self-explanatory.

Indirect processing facilities and auxiliaries include such items as boiler house, catalyst plant (if auxiliary to main processing), water treatment plant, and the like. Frequently it is convenient to divide installed equipment costs according to *processing sections* so that the individual relative costs may be readily evaluated. Those costs involved in engineering the project and construction at the

Estimated Capital Cost Statement

Product________________
Capacity________________

Land and Site Preparation		_____
Buildings and Structures		_____
Auxiliary Facilities		_____
Outside Lines		_____
Process Equipment (a)	_____	
(b)	_____	
Process Piping	_____	
Instrumentation	_____	
Processing Facilities Total		_____
Engineering and Construction		_____
Contingencies		_____
Total Fixed Capital		_____
Raw Materials Inventory	_____	
Materials in Process	_____	
Product Inventory	_____	
Accounts Receivable	_____	
Cash	_____	
Total Working Capital		_____
Total Capital Required		_____

"There is less confusion of terms in estimating capital."

site are included in *engineering and construction.* Of course, there is the ever present item of *contingencies.*

The sum of the costs involved in creating the physical plant is referred to variously as *capital cost, plant cost,* and *fixed capital cost.* The latter term is preferred since it indicates a specific item.

In addition to the fixed capital cost, there is that capital required to lay in stocks of raw materials, build up stocks of products, carry accounts receivable, meet the payroll while starting up, and have some cash in the bank for emergencies. Hence, the need is evident for an item referred to as *working capital.* The sum of the fixed capital and working capital constitutes the *total capital required* to get the project going.

ECONOMIC ANALYSIS

How can the information presented in estimated income and capital cost statements be used to gage the financial attractiveness of the proposal? Chemical plants are built to make profits. The rate of earnings considered attractive varies widely and is governed to a large extent by such factors as the risk of process obsolescence, risk of sudden changes in market conditions, and the nature of the product—whether it is well established or new and untried.

Whatever the situation, the estimated income should be considered in the light of the estimated capital cost of the project. Various ratios of income to capital are used. Their relative significance and utility currently provide the basis for widespread discussion.

The ratio of annual income to the estimated capital is commonly used as a *rate of return on investment* after

Cost Estimation—In few areas of engineering are the variety

Glossary of Terms

Accounts Receivable—The total amount of credit extended to customers.

Administrative Expense—The cost of running the business at the management level, including legal costs, officers' salaries, etc.

Auxiliary Facilities Costs—The cost of power substation, transformers, boiler house, fire control equipment, etc.

Building and Structures Costs—The cost of buildings and structural steel work associated with the process equipment; costs of heating, ventilating, sanitary plumbing and lighting equipment. Electrical wiring and other facilities within the building and/or structural steel work are also included.

Cash—The amount of money kept on hand to meet the regular payroll and to take care of strikes or other emergencies.

Contingencies—Allowance for the escalation of equipment prices, unforeseen engineering fees, items overlooked in construction costs, and slight changes in process design.

Control Lab—The cost of chemical and physical testing of raw materials, intermediates and products. Includes minor trouble-shooting but does not include research.

Depreciation—The retirement factor allowed by the Bureau of Internal Revenue for a comparable plant, or assembled from published tables for individual equipment.

Direct Production Costs—Materials, labor and other expenses consumed directly in making the product.

Engineering and Construction—The design and engineering fees plus the cost of supervising the erection of the plant, either by an outside firm or by company engineers.

Equipment Cost—The total of installed costs of all major items of process equipment, e.g., tanks, pumps, heat exchangers, towers, steam jets, furnaces, etc.

Fixed Capital—The total investment in production facilities, including land, buildings and structures, and auxiliary facilities.

Fixed Production Costs—Usually depreciation, insurance and property taxes.

Freight and Hauling—An indirect production cost covering delivery to the rail head or fob. point.

General Expenses—Selling, research and administrative expenses.

General Plant Overhead—Frequently used as an indirect production cost covering the costs of engineering and drafting, recreation facilities, cafeteria, emergency medical services, receiving and salvage functions, telephone and telegraph, office supplies, repairs on office machines, postage and stationery, etc.

Gross Margin—Net sales less manufacturing cost of sales.

Income before Taxes—Gross margin less general expenses.

Indirect Payroll Expense—An indirect production cost for state unemployment compensation fund contributions, social security taxes, employee liability insurance, group life and health insurance, pension plan, medical exams, routine first aid and state and municipal payroll taxes.

Indirect Production Costs—Expenses incurred in plant operations which do not contribute directly to making the product.

Instrumentation—The installed cost of control valves, instruments, panelboards, instrument air piping and telemetering systems, etc.

Insurance—Fire and explosion insurance on the physical plant investment; also wind and rain insurance if desired.

Labor—A direct production cost for production personnel, such as foremen, operators (all ratings), general mill hands and janitors, but excluding maintenance and service labor.

Land Cost—The cost of unimproved real estate.

Maintenance Payroll—A direct production cost for mechanics (all ratings), pipe fitters, electricians, tinsmiths, carpenters,

providing for gradual capital recovery through depreciation, and is usually expressed on a percentage basis. Since gross margin, income before taxes, and net income may all be used to calculate rate of return, it is obvious that some identifying label should be attached to the term. For example, the use of a term such as *rate of return on investment before taxes* serves to remove ambiguity and to indicate clearly what ratio is meant.

The only rate-of-return ratio which has real significance as possible money-in-pocket is *return on investment after taxes on income*. Even this, however, is misleading when applied over the life of the proposed project, since net income after depreciation assumes gradual capital recovery and, hence, freeing of capital for other purposes. A more appropriate ratio is net income to *average investment*. Using straight-line depreciation, the average investment is the mean of the original capital and the salvage value.

Another ratio frequently used is *payout time*, defined as capital investment divided by annual income plus depreciation. It is essentially the reciprocal of rate of return except that depreciation is added to income. Like rate of return, payout can be and is calculated on a variety of bases, and, consequently, the basis of the calculation should always be indicated. The simplest to calculate is the payout time in years obtained by dividing total capital cost by the gross margin plus depreciation, but many prefer to use payout based on net income plus depreciation.

There are many philosophies behind the calculation of payout. In essence payout time is considered an indication of how quickly the capital invested can be recovered on a short-term operation, assuming the physical facility to be a total loss at the end of the payout period.

Payout has no real significance in the financial history of a successful project. But it is a useful guide in the preconstruction period to indicate the degree to which financial flexibility may be restricted by the new venture and against which anticipated or unexpected hazards can be balanced.

A concept of *margin of profit* should be gained from the estimated income statement. Several yardsticks, such as the ratio of net sales to manufacturing cost of sales, or the ratio of gross margin to manufacturing cost of sales, reveal how critical the relationship is between estimated production costs and anticipated sales. The greater the ratio of sales to cost of sales, the less susceptible the project is to market price fluctuations.

The next consideration is *load factor, operating factor* or *operating rate*. Cost estimates are made at specified fractions of estimated capacity, usually at a load factor between 80 percent and 100 percent. The break-even point provides an estimate of the effect of operating rate on income. It is that operating rate (expressed as a percentage of capacity) where income before taxes is zero. Obviously, the lower the break-even point the greater the chance of the project surviving fluctuating market demand.

Another significant economic yardstick is the *turnover ratio*, which is the annual net sales divided by capital investment. It is particularly useful in characterizing different types of chemical process industries as well as the scale of operations within a given group.

of terms and diversity of their significance so great.

millwrights, masons, laborers and riggers; also included are instrument service men and tool crib attendants.

Maintenance Supplies—A direct production cost for supplies for the periodic inspection and repair of equipment and replacement of parts, including pipe, valves, fittings, bar and flat stock, and equipment spare parts.

Manufacturing Cost of Sales—The total of direct, indirect and fixed production costs (including depreciation).

Materials in Process—The value of materials which have left the raw material storage but have not yet been consigned to product inventory or cleared for shipment.

Net Income—The income after taxes on income.

Net Sales—Value of product, less allowances in the form of contract discounts and commissions, bulk shipments and freight adjustments.

Operating Supplies—The cost of auxiliary materials such as lubricating oil, paint, cleaning equipment, catalysts, work clothes, protective clothing, etc.

Outside Lines—Cost of piping external to the building or steel work, plus the supports and poles for any overhead piping, and the cost of electrical feeders from the power substation.

Packaging—An indirect production cost for bags, drums and tank car rentals.

Plant Office—An indirect production cost covering salaries for clerical personnel such as the production clerk, stenographer-typists, receptionists, payroll clerks and secretaries.

Plant Protection—The cost of providing watchmen, safety and fire inspection, etc.

Process Piping—Total cost of pipe, valves and fittings associated directly with the process equipment; utility and process lines within the building or structural steel work. Ordinarily, it does not include steam lines for building heat or sanitary water lines.

Product Inventory—The value of finished product held in storage to meet seasonal or fluctuating sales demands.

Property Taxes—A fixed cost for city and state taxes on real estate; also miscellaneous levies, such as tax on stills, fire permits, etc.

Raw Materials (or Ingredients)—Cost of all materials purchased inside or outside the company for use in processing, including associated freight charges.

Raw Materials Inventory—The value of raw materials held in storage or stock pile.

Research Expense—The cost of process and product improvement, including the support of fundamental or unrelated research in other fields.

Royalties—Payments for the use of patented methods and processes.

Selling Expense—The cost of getting and processing orders, including salaries, commissions, advertising and customer service.

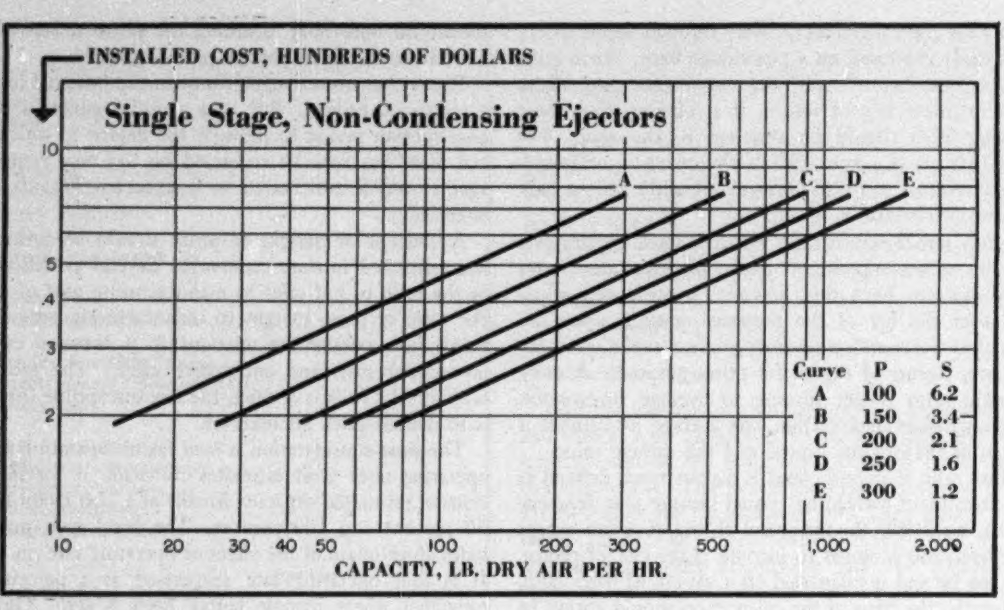
Site Preparation—Cost of grading, road building, putting in railroad siding, and landscaping.

Supervision Payroll—An indirect production cost for plant supervision, including plant superintendent, plant engineer, accountant, sales and legal personnel, and production controller.

Taxes on Income—Corporate income and excess profits taxes, payable to Bureau of Internal Revenue. Currently range between 52 and 67 percent of income before taxes.

Utilities—The cost of fuel, electric power, water, steam, used to run the process; this must be distinguished from any such oil, gas, coal, water or steam which actually enter the process as raw materials.

Working Capital—The total investment in liquid assets, such as cash and inventories.



Ejectors Show Low First Cost

Annual operating costs are high by comparison but many advantages stem from simple design of these vacuum producers. Maintenance is low and there are no lubrication or sealing problems to lick.

JOHN C. TALLMAN

Of all the classes of chemical engineering equipment, ejectors are unique in that their annual operating costs are usually much greater than the installed equipment cost. Ejectors have low first cost because they are simple in design, have no moving parts and occupy a small space. Operating costs of ejectors are high, however, because they consume large amounts of steam. In addition, multi-stage ejectors with intercondensers require appreciable quantities of water.

In supplying vacuum for industrial processes, ejectors are often preferred to mechanical vacuum pumps because of lower initial cost, lower maintenance cost, and simplicity of design (no lubrication required, no sealing liquid required, easy selection of materials for corrosive service). Lack of moving parts means there is no wear except erosion, which can be controlled by proper selection of materials of construction. Absence of lubrication permits ejectors to function in the presence of high temperature steam or other gases which would emulsify or destroy the lubricating or sealing oil of mechanical vacuum pumps

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GENERAL TYPES

There are four general types of ejectors, as follows:

1. *Single Stage*—This is the simplest type for suction pressures between atmospheric and about 100 mm. Hg Abs. These ejectors are used where low first cost outweighs steam economy, and are of particular value when used for intermittent loads, such as for rapid evacuation of batch-operated equipment.

2. *Multi-Stage, Non-Condensing*—This type permits lower suction pressures than the single-stage ejector. Steam consumption is high because each stage must handle the ejector steam from the stage ahead of it. Such ejectors are used in preference to multi-stage, condensing ejectors, where first cost outweighs steam economy, where use is intermittent, or where cooling water is unavailable.

3. *Multi-Stage, Condensing*—In this type, intercondensers between stages condense steam from the previous stage, thus reducing the load to the following stage. These ejectors are particularly efficient for air-water vapor mixtures, since only the first stage is required to handle the total mixture. Where large vapor loads are involved, as in ejectors for stills, crystallizers, etc., the first stage is called a booster because it boosts the pressure to a point where the vapor can be condensed in the intercondenser.

4. *Multi-Stage, Combination Condensing and Non-Condensing Stages*—For extremely low suction pressures, 4 or 5 stage ejectors are required. Because the pressure from the early stages of such ejectors is too low to permit condensation of the ejector steam in an intercondenser, such stages are built non-condensing, and the following stages are made condensing.

Table I gives the approximate range of suction pressures for ejectors having from 1 to 5 stages. In the region where these ranges overlap, choice of the number of stages will depend upon the relation of first cost (lower for fewer stages) and operating economy (lower for more stages).

Table I—Suction Pressures Attainable in Multi-Stage Jets

No. of Stages in Series	Suction Pressure Range, mm. Hg Abs.
1	760 — 75
2	125 — 5
3	50 — 3
4	5 — 0.2
5	0.3 — 0.05

P = **Steam ejector suction pressure, mm. Hg Abs.**
S = **Lb. per hr. steam/ lb. per hr. dry air.**
W = **Gal. per min. water/ lb. per hr. dry air.**

EJECTOR CAPACITY

One of the most difficult tasks in the selection of an ejector system for a particular job is the determination of its capacity. Ejector capacities are normally expressed in pounds of dry air removed per hour. As a rough approximation in determining capacity, the amount of water vapor or other gases present with the air should be added to the weight of the dry air. The capacity of an ejector at a given vacuum is somewhat increased when handling gases with molecular weights higher than air. On the other hand, ejector capacity is reduced as gas inlet temperature rises.

In general, the load on any ejector system will be a mixture of condensable and non-condensable gases. Economy of process usually dictates that the condensable portions of this load be removed, insofar as possible, in precondensers ahead of the ejector system. The remainder of the condensable gases will normally be removed in the first intercondenser in the ejector system.

The non-condensable load can come from four sources as follows:

1. *Air Leakage*—It is generally appreciated that it is cheaper to build and maintain process equipment partially airtight than to purchase and operate over-size jet equipment. The chief sources of air leakage are flanged joints, stuffing boxes on valves and agitator shafts, sight glasses, gage glasses, etc. It should be possible to keep the total air leakage, even at high vacuum, in the range of 5-15 lb. per hr. of dry air. In systems where air leakage into the product can cause oxidation which affects product quality, it may be necessary to design for negligible air leakage, by using welded joints wherever possible.

2. *Condenser Water*—Where barometric condensers are used, a small amount of air and other dissolved gases will be released by the heating of the water in the condenser. This can amount to about 1-2 lb. per hr. of dry air per 100 gpm. of condenser water, so it is not a major source of ejector load.

3. *Process Materials*—The amount of non-condensables released by the process materials can usually be calculated or determined at a given pressure and temperature, but good design dictates a choice of processing conditions which will minimize degradation of the materials.

4. *Pressure Control Devices*—Since maintenance of uniform pressures is required in many chemical engineering operations, such as distillation, crystallization, etc., pressure control devices are required. Some of these devices employ an ejector system which has excess capacity for the maintenance of the required pressure. Pressure is then regulated by an instrument-actuated bleed of air or inert gas into the system.

For maintenance of a prescribed pressure in process equipment, ejector systems having capacities of 15-40 lb. per hr. of dry air are usually adequate. However, for batch systems operating on fairly short process cycles, it is often necessary to evacuate the entire system from atmospheric pressure to the operating pressure at relatively frequent intervals. For such systems, it is good design to provide an ejector system for maintenance of the desired vacuum during the process cycle, and to provide an additional, high-capacity, single-stage priming ejector for quick evacuation. The priming ejector is then shut down.

All steam-jet ejectors have an optimum vacuum-capacity performance curve. Capacity can be altered appreciably only by changing the vacuum or the ejector dimensions. If ejector equipment requires flexibility, such as for pilot plant or fine chemical operations where the same equipment may be used for several processes or products, it is good practice to provide multi-element ejectors, either single or multi-stage, in parallel. Then, for variable loads, each element is designed to operate part-scale for full load. Such an arrangement permits shutting down one or more of the parallel elements when not required, thereby effecting substantial steam saving.

COST FACTORS

The factors governing ejector costs include:

1. *Operating Steam Pressure*—In general, ejector cost increases as ejector steam pressure is reduced. Since an ejector will not operate efficiently below design pressure, it should be designed for the minimum steam pressure available. When discharging to atmospheric pressure, steam pressures of 50-75 psig. can be used, although steam consumption will be fairly high. A steam pressure of 100 psig. is usually considered standard. Booster ejectors, which discharge at very low pressures, can be designed to operate on steam pressures as low as 10 psig.

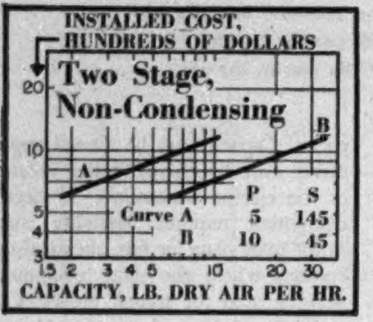
If an ejector is supplied with steam above design pressure, it will perform efficiently up to the point where the diffuser becomes overloaded. However, the steam consumption will be increased in direct proportion to the ratio of the actual operating pressure to the design pressure. It is good practice to install a steam pressure regulating valve to maintain a uniform steam pressure at the ejector.

While not a primary factor in determining ejector costs, steam quality is important in ejector operation, because

Table II—Special Materials of Construction

Materials of Construction*	Multiply Cost Of Standard Ejector By: Single-Stage	Multi-Stage
Haveg	1.2	1.5
Carbon-Lined	1.7	—
Bronze	1.2	1.7
Stainless Steel	2.0	2.75

* All parts of the ejector coming in contact with steam or process materials to be of the special material.



ejectors will not perform efficiently on poor quality steam. A steam strainer is usually installed on small ejectors to remove dirt which would otherwise clog the nozzle. Water droplets should be removed in a conventional separator, or they will cause severe erosion of the ejector throat. Slightly superheated steam may be employed to ensure dry steam, but additional superheat is wasteful because it has no additional benefit. Steam containing air is exceptionally wasteful in multistage ejectors because some of the air from the steam is added to the load on the following stages.

2. *Back Pressure*—Ejectors are normally designed to discharge to the atmosphere. Any increase in back pressure increases the cost of the ejector system, as well as the steam consumption, although some increase might be justified if the plant has a use for the low-pressure steam from the discharge. An ejector can operate efficiently against a back pressure higher than design only if the steam pressure is increased above design pressure—such operation results in a decrease in capacity and an increase in steam consumption.

3. *Number of Nozzles*—Cost increases with the number of nozzles used to supply steam to the ejector. In current practice, single large nozzles are preferred to multiple small nozzles because clogging is minimized. In addition, small nozzles are fragile, easily broken and the flows from the many nozzles may interfere with each other.

4. *Capacity*—As shown on the cost graphs, equipment and operating costs increase with capacity at any given suction pressure.

5. *Suction Pressure*—The cost graphs show that equipment and operating costs increase rapidly as suction pressures are lowered.

6. *Number of Stages*—The cost graphs show that for any given suction pressure, as the number of stages is increased, equipment costs increase sharply, but utilities requirements are reduced.

7. *Condenser Requirements* — In multi-stage ejectors, costs are appreciably affected by the number and type of condensers employed. While non-condensing ejectors have lower first cost, condensing ejectors have much greater steam economy because the motive steam from each stage is condensed in the intercondenser, thus reducing the load to the stage which follows.

There are two general types of condensers used for intercondensers; shell-and-tube condensers and barometric condensers. Barometric condensers suffer from the disadvantage of a long (34 ft.) tail pipe and from the fact that all the energy of the condensed steam is wasted. However, they have the distinct advantage of lower first cost, easy adaptability for handling corrosive vapors, adaptability for handling dirty or corrosive water, freedom from fouling of condenser tubes, and elimination of a condensate removal pump. All the data on the cost graphs for multi-stage, condensing ejectors are for systems using barometric intercondensers.

Assumptions:

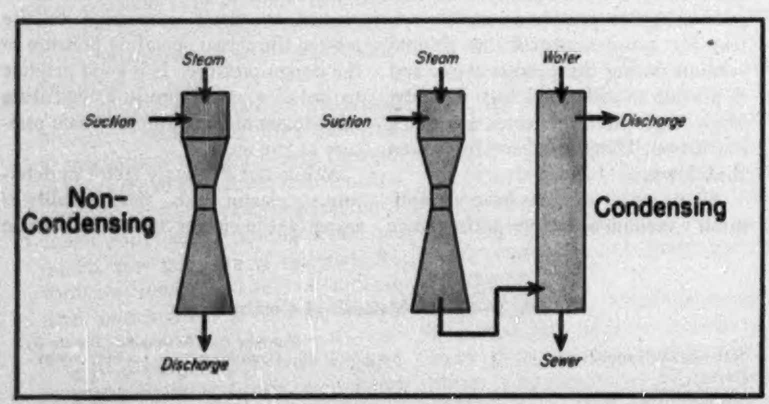
- ▶ Average S and W values.
- ▶ Steam pressure at 100 psi.
- ▶ Atmospheric discharge pressure.
- ▶ One nozzle per ejector.
- ▶ Barometric intercondensers.
- ▶ Condenser water at 85 deg. F.
- ▶ Standard construction materials.
- ▶ ENR construction index—550.

Besides intercondensers, ejector systems sometimes have precondensers or aftercondensers. These condensers add to the cost of the installation and are only used when justified by exceptional circumstances. Precondensers are used if a large proportion of the ejector load is condensable at the suction pressure, to minimize the load on the rest of the system, or possibly to recover process materials which would otherwise be lost in the ejector system. Aftercondensers permit no additional steam saving, but may be desired to prevent discharging large quantities of steam to the atmosphere.

8. *Materials of Construction*—The usual materials of construction for ejectors, broken down by component parts, are: steel or cast iron for steam chest, suction chamber and diffuser; stainless steel for steam nozzle; welded steel or cast iron for barometric condenser. A surface condenser usually has copper tubes, Muntz metal tube sheets and cast iron or steel shell and heads.

Because of their simplicity and ease of construction, however, ejectors can be constructed of nearly all machinable metals and many special nonmetallic materials, such as carbon or Haveg. Thus, where corrosion is a problem, materials may usually be specified which are highly resistant to the particular conditions encountered.

Of course, the substitution of corrosion-resistant materials for the standard materials of construction increases the cost of the ejectors. Reference to Table II gives factors which may be applied to the cost graphs in estimating prices



BOTH ECONOMIC and service considerations determine which basic type or combination will best meet requirements.

of ejectors with non-standard materials of construction.

COST GRAPHS

The five graphs of cost data show the approximate installed* costs for non-condensing ejectors (1- and 2-stage) and for condensing ejectors (2-, 3- and 4-stage) as a function of dry air capacity. They also show the approximate steam and water consumptions for these ejectors at varying capacities.

By increasing utilities consumption with respect to dry air capacity, it is possible to design less expensive ejector systems than shown on the cost graphs. Similarly, more expensive ejectors could be designed to operate with decreased consumption of steam and water. Determination of the best size for the optimum combination of initial cost and utilities consumption requires a detailed study of the specific installation.

OPERATING COSTS

Operating costs of ejectors consist almost entirely of costs of steam and water consumed. The graphs of ejector costs give the approximate steam and water requirements, assuming steam at a pressure of 100 psig. and condensing water at 85 deg. F. No attempt has been made to translate these requirements into actual steam and water costs because they vary so widely for different plant locations.

Since properly designed ejectors can run for days with slight attention, labor and maintenance costs are negligible.

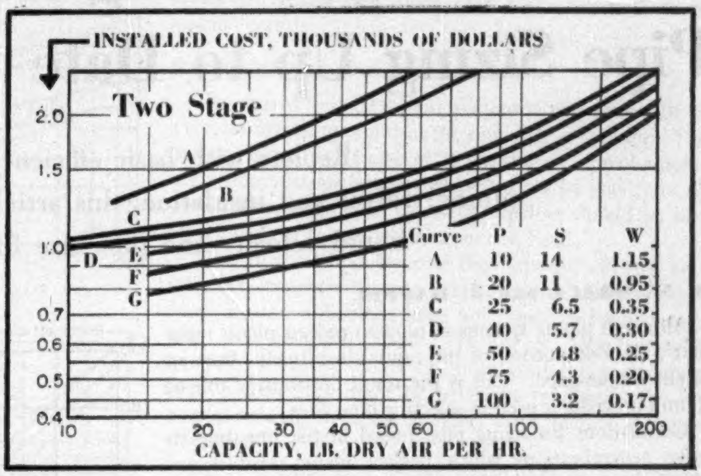
ACKNOWLEDGEMENTS

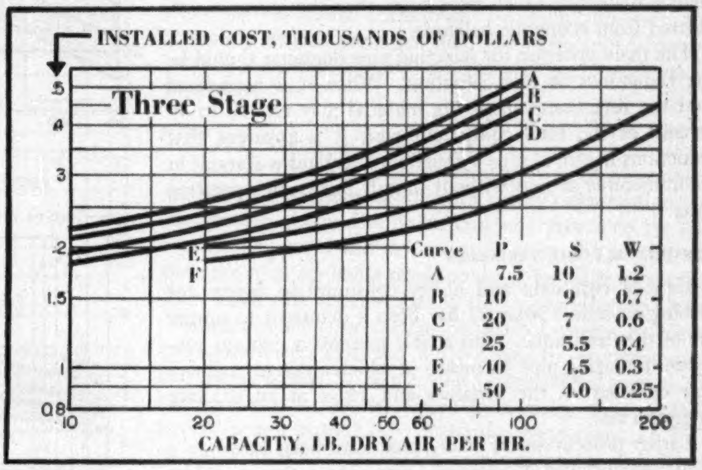
The help of A. E. Kroll of the Polychemicals Department, E. I. du Pont de Nemours & Co., is gratefully appreciated.

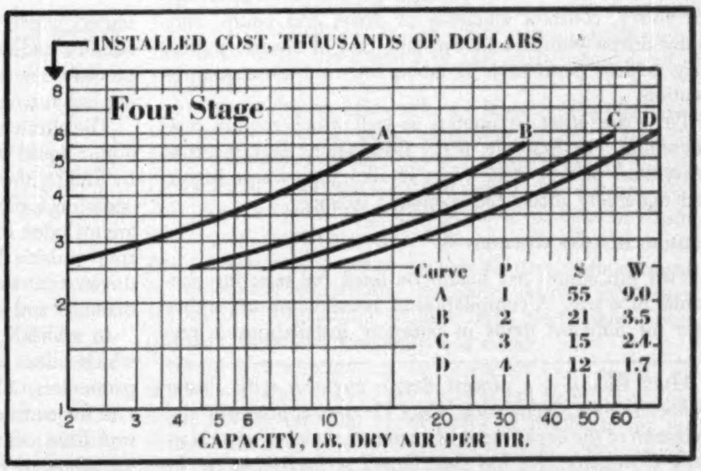
The following equipment manufacturers generously supplied data on ejector specifications and costs: Condenser Service & Engineering Co., Hoboken, N. J.; Croll-Reynolds Co., Westfield, N. J.; Elliott Co., Jeannette, Pa.; Graham Manufacturing Co., New York; Ingersoll-Rand Co., New York; Manning, Maxwell & Moore, Inc., Watertown, Mass.; Penberthy Injector Co., Detroit, Mich.; Schutte and Koerting Co., Cornwells Hts., Pa.

* Installed costs include manufacturer's price, freight and erection at the plant site, but do not include piping except the tail pipe on barometric condensers.

Cost of Condensing Ejectors







COSTS of multi-stage, condensing ejectors are for systems using barometric intercondensers, but not precondensers or aftercondensers.

New Cost Data Bring Economic Pipe Sizing Up to Date

Replete with basic efficiency and economic data on pumps, piping, valves and insulation, this article helps you select the economic liquid velocity and pipe size for any process plant installation.

R. M. BRACA and J. HAPPEL

Although piping systems in modern process plants represent a sizeable portion of the capital investment, they are often overdesigned. This is the result of arbitrary rule-of-thumb procedures used in selecting pipe sizes.

Correlations for sizing pipe found in the literature involve generalizations which neglect many variables and often give results of questionable accuracy. Moreover, in many actual individual cases ordinary pipe sizing procedures yielded diameters which were larger than the optimum calculated from economic balances.

The main criterion for selecting pipe diameter should be the economics of each situation. When it is considered that the investment in piping material may run 20 to 40 percent of the total equipment cost, it is apparent that reductions in size of pipe throughout the plant will result in a considerable savings without unduly increasing operating costs.

CONSIDER ALL THE VARIABLES

Lack of cost data and utility consumption figures for making economic balances has been a deterrent to proper use of this technique. This article presents a rigorous procedure for sizing pipe by means of which a design engineer may consider all the variables and arrive at an accurate optimum size.

Earlier procedures for sizing pipe have been based on a series of simplified assumptions regarding certain variables which could alter considerably the economic picture. These procedures assume constant payout time (generally, ten years), constant efficiency of driver and pump, only motor-driven pumps, and constant cost of electric power; they neglect items such as labor, line-size valves and insulation.

There are other parameters as well which require consideration. For example, many installations require extra-heavy steel pipe or some types of alloy pipe whose higher cost materially affects the economic balance.

CHOICE OF TWO METHODS

Two procedures are herein outlined for selecting economic pipe size. A compilation of average cost and utility data for different items in pumping installations is presented which will enable a design engineer to make a detailed individual economic balance for any line. This procedure is time-consuming, but certain situations involving expensive piping justify the extra time.

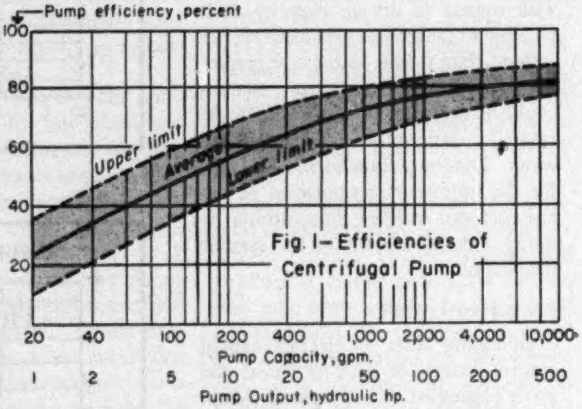


Fig. 1—Efficiencies of Centrifugal Pump

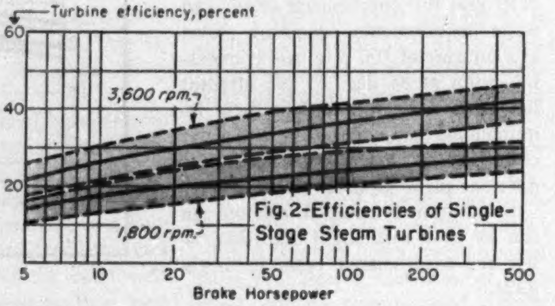


Fig. 2—Efficiencies of Single-Stage Steam Turbines

The alternate procedure involves the use of tables of economic liquid velocities. These are derived from the calculus by finding the minimum total yearly cost of installing and operating a piping system and pumping installation. Tables are included for two types of pumping installations—3,600 rpm. turbine-driven centrifugal pumps and electric motor-driven centrifugal pumps—and contain variables of pipe diameter and specific gravity of the liquid flowing.

In addition, curves of correction factors are presented which allow adjustments for variations in the following parameters: Cost of steam and electric power; ideal steam rate for turbine drives; payout time; and differential pressure head on pump. The magnitude of these corrections for values of parameters other than those assumed in the base cases indicates the errors involved in neglecting their effect in an economic balance.

Mike Braca is a process design engineer with Foster Wheeler Corp., New York. John Happel is professor and chairman of the department of chemical engineering at New York University. He has contributed several times in the past to our series of articles on cost estimation and economics.

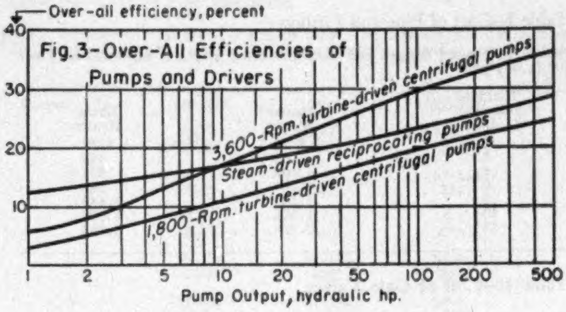


Fig. 3–Over-All Efficiencies of Pumps and Drivers

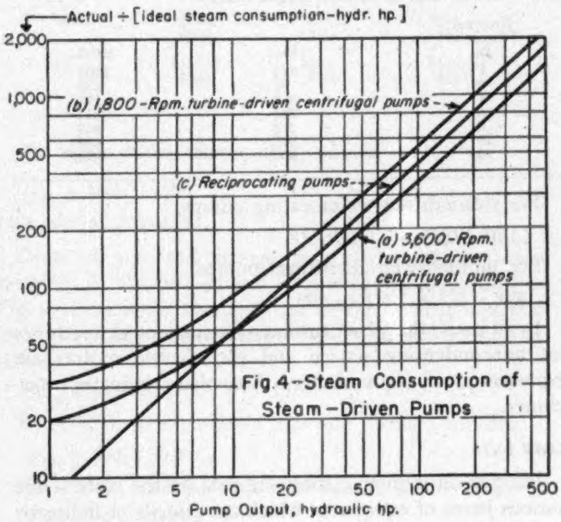


Fig. 4–Steam Consumption of Steam-Driven Pumps

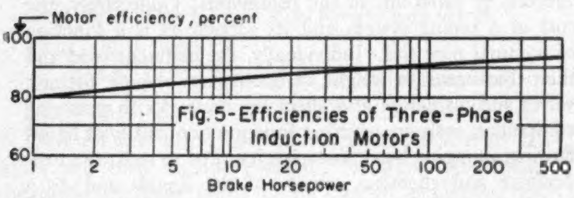


Fig. 5–Efficiencies of Three-Phase Induction Motors

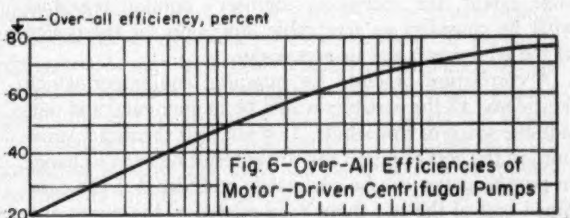


Fig. 6–Over-All Efficiencies of Motor-Driven Centrifugal Pumps

It is possible to make up similar tables and correction curves for 1,800-rpm. turbine-driven centrifugal pumps and reciprocating pumps, since cost and efficiency data are included for these items. It is felt, however, that since these types of equipment are not used as widely as those considered for the base cases, the extensive calculations required for the tabulations and correction curves are not justified. Anyone can calculate economic velocities with the data presented in this article; in fact, where plants have economic situations differing considerably from those assumed in the base cases, it is strongly recommended that the tables be recalculated using cost data applicable to the specific plant.

WATCH THESE LIMITATIONS

The curves and treatment presented are essentially for a system involving piping at the discharge of a pump. They can also be applied, however, to the suction side of a pumping system, except in cases where flow is by gravity or differential head. In such cases the pipeline should be sized on the basis of the net positive suction head.

Also, this method assumes that erosion will not enter into the economic considerations. In the authors' experience, erosion difficulties have not normally been encountered with velocities below 20 ft. per sec. However, when handling corrosive fluids or those containing suspended solid particles, it might be necessary to modify the economic balance in order to take these factors into consideration.

Other complicating factors which may be encountered in piping systems are the necessity for designing sufficient mechanical strength into unsupported pipe spans or to allow for vibrational conditions. Normally, however, the economic analysis presented here should be applicable and provide a reasonably sound basis for the rapid selection of pipe sizes.

UTILITIES DATA

In order to evaluate the operating costs of a pumping system, it is necessary to know its utility consumption. In the absence of any specific information relative to the efficiencies of pumps and drivers, as is often the case at the time the lines are being sized, use must be made of average data. Such data are compiled in the graphs presented here.

Efficiency data for a large number of pumps, turbines and motors were gathered and averaged to give the curves in Figs. 1, 2, and 5. Efficiencies of centrifugal pumps, although more accurately related to capacity, were plotted against pump output, i.e., hydraulic horsepower, at 85.7 psi.; this makes it possible to combine pump and driver efficiencies into over-all efficiencies (Figs. 3 and 6), which are very useful in estimating utility consumption directly. The advantage gained is that the input to the driver can be directly estimated from the power output of the pump, the latter being the product of the capacity and head of the pump.

For steam drivers, efficiencies are based on the ideal work obtained by the isentropic expansion of steam from its initial conditions of pressure and temperature to the exhaust pressure. These conditions are: For live steam, 100-250 psig. and 0-100 deg. F. superheat; for exhaust steam, 10-25 psig. back pressure. The over-all efficiencies for pump and driver, therefore, include thermodynamic as well as mechanical efficiencies. Similarly, over-all efficiencies for motor-driven pumps include both electrical and mechanical efficiencies for pump and driver.

Steam consumption can be predicted from over-all efficiencies of steam-driven pumps, if it can be assumed that there is little variation in efficiency of machines for the steam conditions generally encountered in pumping systems. If the steam conditions are confined to the ranges specified above, the assumption of constant efficiency is reasonable and sufficiently accurate for the purposes intended here.

NOMENCLATURE

ASC — Actual steam consumption, lbs. per hr.
C_e — Cost of electricity, $ per kwh.
C_i — Installed cost of pipe insulation, $ per 100 ft. of pipe
C_{me} — Cost of motor-driven centrifugal pumps, $
C_p — Installed cost of pipe, $ per 100 ft.
C_s — Cost of steam, $ per 1,000 lb.
C_{sr} — Cost of steam-driven reciprocating pumps, $
C_{te} — Cost of steam turbine-driven centrifugal pumps, $
C_T — Total yearly cost, $
C_v — Cost of gate valves, $
D — Pipe diameter, in.
E — Efficiency, percent
f — Fanning friction factor
HP_H — Hydraulic horsepower
ISR — Ideal steam rate, lb. steam per hr. per horsepower, based on isentropic expansion of steam
KW — Electric power consumption, kw.
L — Length of pipe, ft.
L_e — Equivalent length of pipe, ft.
m — Yearly maintenance, fraction of investment cost
n — Number of gate valves
Q — Quantity of liquid flowing, gpm.
T — Payout time, yr.
Δp_s — Differential pressure head on pumps exclusive of pipe friction, psi.
ρ — Density of liquid, lb. per cu. ft.

The over-all efficiency is based on the equation:

$$E = (ISR)\,(HP_H)/(ASC)$$

Curves of steam consumption based upon this relationship were prepared by plotting the quantity (ASC/ISR) vs. pump output in Fig. 4. The value of the ordinate times the ideal steam rate for the specified steam conditions gives the actual steam consumption.

The electrical energy consumption for motor-driven centrifugal pumps is obtained directly by using Fig. 7. Kilowatts are plotted against pump output based on the over-all efficiencies in Fig. 6.

The following mathematical expressions were derived from Figs. 4 and 7 by fitting power equations to the curves:

For 1,800-rpm. turbine-driven centrifugal pumps,

$$(ASC)/(ISR) = 23.0 + 9.0(HP_H)^{0.87}$$

For 3,600-rpm. turbine-driven centrifugal pumps,

$$(ASC)/(ISR) = 14.0 + 6.0(HP_H)^{0.87}$$

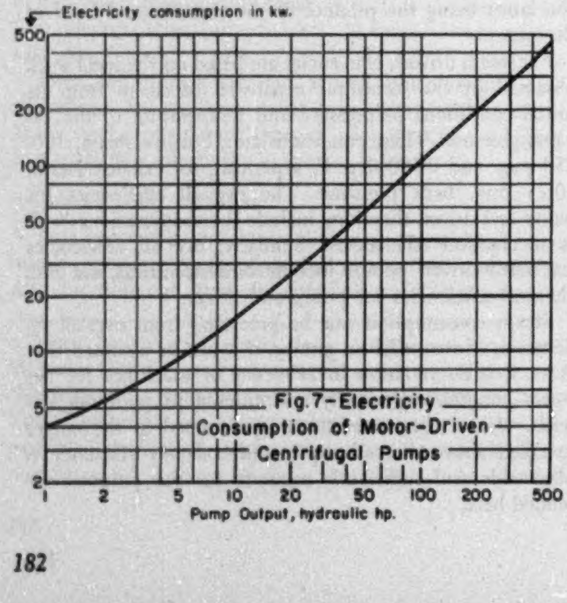


Fig. 7—Electricity Consumption of Motor-Driven Centrifugal Pumps

Table I—Cost of Pipe and Fittings

Basis: Fabricated flanged and welded, erected in place, expressed as $ per 100 ft. of pipe.

Nominal Diameter, In.	Standard Weight	Extra Heavy
2	$223	$273
3	362	448
4	508	622
6	781	987
8	1,155	1,449
10	1,648	1,994
12	2,125	2,553

Table II—Cost of Gate Valves

Basis: ASA RF cast carbon steel, flanged, OS&Y.

Nominal Diameter, In.	150-lb.	300-lb.
2	$74	$102
3	92	135
4	128	175
6	201	311
8	278	458
10	377	639
12	505	861

For steam-driven reciprocating pumps,

$$(ASC)/(ISR) = 8.0(HP_H)^{0.87}$$

For motor-driven centrifugal pumps,

$$KW = 2.5 + 1.5(HP_H)^{0.926}$$

In all cases, the steam turbines are single-stage machines for noncondensing service and the electric motors are explosion-proof, squirrel-cage, three-phase induction machines.

COST DATA

Basic to an economic study are data on the costs of the various items of equipment which are directly or indirectly affected by variations in the parameters. Collectively, the cost of a piping system and its accessories is a function of nominal pipe size. Individually, the materials used and their thicknesses or weight, as in the case of pipe, fittings, valves and insulation also affect the costs. With pumping equipment, costs are mainly a function of quantity of liquid flowing, pumping head, materials required to resist the temperature and chemical activity of the liquids and, to a large extent, the individual engineer's opinion regarding what he considers an acceptable minimum for the design of the equipment and its accessories.

A correlation of costs for pumping equipment which considered all the variables would be monumental and outside the scope of this article. It is felt that the minor variations in the cost of pump and driver resulting from a change in pipe diameter can be adequately considered if the combined cost of the two items were related to the pump output in hydraulic horsepower. This has been done for single-stage steam turbine-driven centrifugal pumps, motor-driven centrifugal pumps and steam-driven reciprocating pumps.

The curves derived from analysis of the costs of a considerable number of pumps are shown in Fig. 8. The data actually fell along bands, from which were selected average curves that would represent with sufficient accuracy the trends in costs.

Each curve can be represented by a suitable mathematical equation. For turbine-driven centrifugal pumps,

$$C_{te} = 1{,}000(HP_H)^{0.48}$$

For motor-driven centrifugal pumps,

$$C_{me} = 650(HP_H)^{0.40}$$

Table III—Cost of Pipe Insulation

Basis: Installed cost per 100 ft. of straight pipe. For approximate cost of insulating valves and fittings as well as straight pipe, multiply values in table by 1.35. "M" denotes 85 percent magnesia, "S" denotes Superex or high-temperature block insulation; number immediately following denotes thickness in inches.

Nominal Pipe Diameter, In.	Temperature Range, Deg. F. 200-270	270-350	350-400	400-500	500-600	600-700	700-800
2	M-1 $113	M-1 $113	M-1½ $137	M-2 $156	M-2 $156	S-1½ + M-1½ $289	S-1½ + M-2 $356
3	M-1 $124	M-1 $124	M-1½ $152	M-2 $181	M-2 $181	S-1½ + M-1½ $327	S-1½ + M-2 $388
4	M-1½ $135	M-1½ $135	M-1½ $164	M-2 $216	M-2 $216	S-1½ + M-1½ $387	S-1½ + M-2 $458
6	M-1½ $158	M-1½ $206	M-2 $267	M-2 $267	M-2½ $353	S-1½ + M-2 $476	S-1½ + M-2½ $567
8	M-1½ $191	M-1½ $233	M-2 $319	M-2½ $404	M-2½ $404	S-1½ + M-2 $556	S-1½ + M-2½ $660
10	M-1½ $227	M-1½ $274	M-2 $370	M-2½ $479	M-2½ $479	S-1½ + M-2 $626	S-1½ + M-2½ $857
12	M-1½ $302	M-2 $430	M-2½ $535	M-3 $606	M-3 $606	S-1½ + M-2 $706	S-1½ + M-2½ $993

For steam-driven reciprocating pumps,

$$C_{sr} = 550(HP_H)^{0.40}$$

PIPE AND ACCESSORIES

Costs of pipe and fittings, gate valves and insulation are given in Tables I, II and III and shown graphically in Fig. 9. Here again, the costs can be expressed in equation form. For 100 ft. of standard weight pipe and fittings, installed,

$$C_{swp} = 90 + 49D^{1.5}$$

For 100 ft. of extra-heavy pipe and fittings, installed,

$$C_{xhp} = 120 + 60D^{1.5}$$

For 150-lb. ASA RF cast steel flanged gate valves,

$$C_{150v} = 40 + 11D^{1.5}$$

For 300-lb. ASA RF cast steel flanged gate valves,

$$C_{300v} = 40 + 19D^{1.5}$$

For 100 ft. of 400-500 deg. F. insulation, installed,

$$C_I = 125 + 11D^{1.5}$$

Data for valves and insulation were obtained from vendors, and costs include discounts for purchases of large quantities of these items. In the case of insulation, costs include labor for erection and material for weatherproofing. The thicknesses of insulation shown in Table III are based on standards used by Foster Wheeler Corp. for the design of petroleum and chemical plants. In the average process plant, the cost of insulating bent pipe, fittings and valves will increase the cost of insulation to 1.35 times that for insulating straight pipe only; this factor should be applied to the data in Table III and Fig. 9.

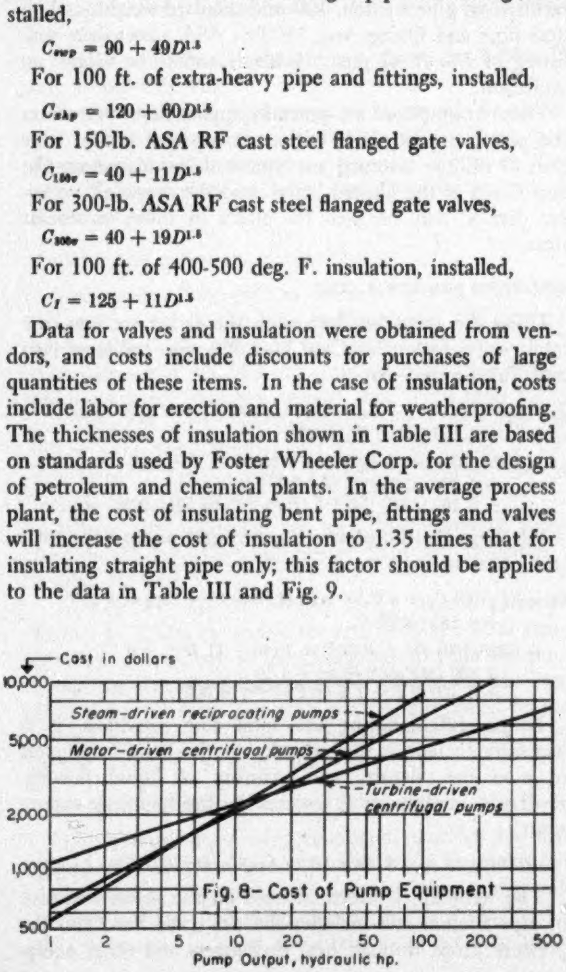


Fig. 8—Cost of Pump Equipment

DATA FROM ACTUAL PLANT JOBS

Information on the cost of purchasing, fabricating and erecting pipe and fittings was derived from a number of actual process plants erected recently by Foster Wheeler. This cost item is important in economic analyses for sizing lines, and the advantage of having accurate data enhances the value of this article. A considerable part of the cost of piping covers the costs of labor in fabricating and welding the pipe; neglecting this item will certainly give inaccurate results.

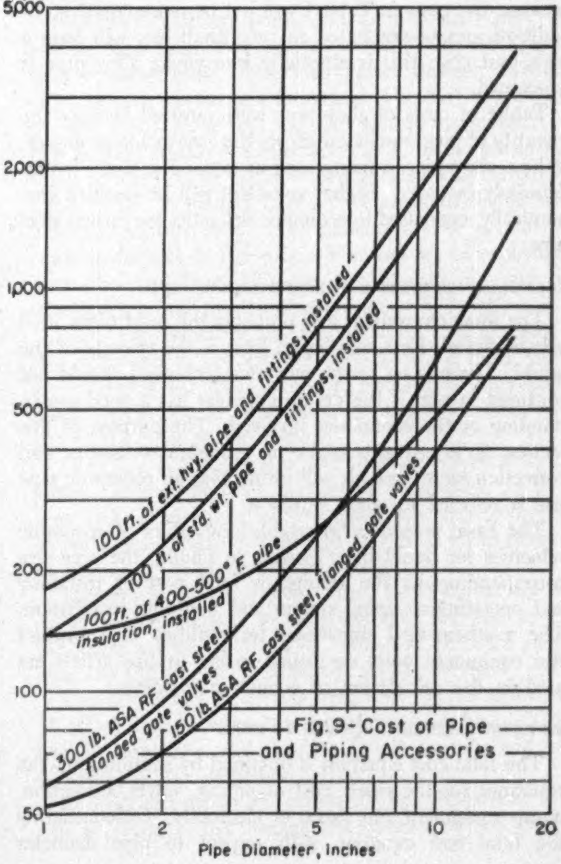


Fig. 9—Cost of Pipe and Piping Accessories

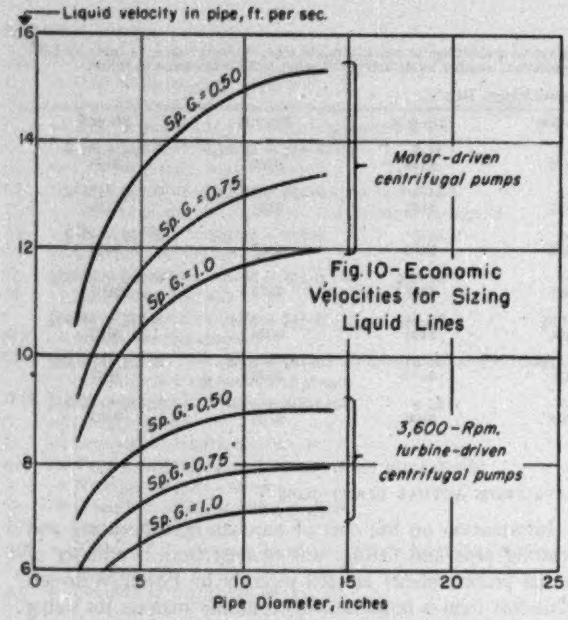


Fig. 10—Economic Velocities for Sizing Liquid Lines

In certain cases the data for piping costs will not be generally applicable, and an individual study of costs may be required. The data for the cost of pipe and fittings assumes an average number of fittings in a given length of pipe, but this information was not recorded. If a line has very few bends and valves in it, as in the case of lines to and from tankage, the costs in Table I will not be representative. In addition, piping purchased in very small lots will have a high unit cost; this is especially true where alloy pipe is concerned.

Tables of costs of alloy pipe were omitted because the quantity of pipe purchased affects the cost to a large degree. Where alloy pipe is being used an economic study is very definitely in order. Higher velocities will be justified economically, compared to economic velocities for carbon steel pipe.

ECONOMIC VELOCITIES IN SIZING LIQUID LINES

The most convenient and probably the most often used rule of thumb for sizing liquid lines is the velocity of the liquid. There is no reason why this technique should not continue in use, if the design engineer has a good understanding of the economics involved. The purpose of this section is to present tables of economic velocities and correction factors which will insure that an economic pipe size is selected for each situation.

The basic procedure in establishing tables of economic velocities for liquid lines consists in finding the pipe size corresponding to the minimum total cost of installing and operating a piping system and pumping installation. The mathematical equations for utilities consumption and equipment costs developed earlier in this article are used in the calculation of economic velocities.

DIFFERENTIATE AND EQUATE TO ZERO

The total cost equation is obtained by summing up the equations for the yearly cost of piping, valves, insulation, pump equipment and steam or electricity. Differentiating the total cost equation with respect to pipe diameter (while holding constant the density and quantity of liquid flowing) and setting the derivative equal to zero yields a general equation for economic pipe size. By calculating the liquid velocity for each pipe diameter which is an economic size for a given density and quantity of liquid flowing, we obtain what is popularly termed as the "economic velocity."

In adding the investment and operating costs, it is necessary to establish a payout time and an operating factor. This study assumes in the base cases a payout time of two years and allows corrections to be made for payout times in the range of one to five years. A six percent factor is added to all capital costs to cover the yearly cost of maintenance. It is also assumed that the installation will operate 8,150 hours per year for an operating factor of 93 percent.

TURBINE OR MOTOR DRIVES

Economic velocities have been calculated for two cases—one in which a 3,600-rpm. steam turbine-driven centrifugal pump is used, the other using a motor-driven centrifugal pump. For these cases the following assumptions were made:

Payout time, two years; steam cost, $0.50 per 1,000 lb.; ideal steam rate, 20 lb. per hp.-hr.; cost of electricity, $0.005 per kwh.; differential pressure head on pump exclusive of pipe friction, 100 psi.; standard weight, carbon steel pipe and fittings and 150-lb. ASA gate valves consisting of 250 ft. of pipe, 20 bends and seven valves; no insulation.

These assumptions are generally applicable to petroleum and petrochemical plants within process unit limits. The costs of utilities assumed are typical of some areas on the East Coast of the United States, and the economic velocities derived may be used for plants in those or similar areas.

EQUATIONS FOR TOTAL COST

Using the equations derived in the earlier sections, the total cost equation for Case I—3,600-rpm. turbine-driven centrifugal pump—is:

$$\begin{aligned}C_T = {} & [(L/100)\,C_p + n\,C_v + 1.35\,(L/100)\,C_I + C_{ie}]\,(m + 1/T) \\ & + 8{,}150\,(ASC)\,(C_s/1{,}000) \\ = {} & [(250/100)\,(90 + 49D^{1.5}) + 7\,(40 + 11\,D^{1.5}) + 0 \\ & + 1{,}100\,(HP_H)^{0.82}]\,(0.06 + 1/2) \\ & + 8{,}150\,(ISR)\,[14 + 6\,(HP_H)^{0.87}]\,(0.50/1{,}000)\end{aligned}$$

For Case II—motor-driven centrifugal pump—the total cost equation is:

$$\begin{aligned}C_T = {} & [(L/100)\,C_p + n\,C_v + 1.35\,(L/100)\,C_I + C_{me}]\,m + 1/T) \\ & + 8{,}150\,(KW)\,C_e \\ = {} & [(250/100)\,(90 + 49D^{1.5}) + 7\,(40 + 11\,D^{1.5}) + 0 \\ & + 650\,(HP_H)^{0.4}]\,(0.06 + 1/2) \\ & + 8{,}150\,[2.5 + 1.5\,(HP_H)^{0.925}]\,(0.005)\end{aligned}$$

Before differentiating the total cost equations, it is necessary to reduce the variables to the basic parameters of pipe size, density and quantity of liquid flowing. Hydraulic horsepower is replaced by the following expression:

$$HP_H = (\Delta p_s + 8.63 \times 10^{-4}\,f\,L_e\,Q^2\,\rho/D^5)\,(Q/1{,}714)$$

The term Δp_s is the total head on the pump exclusive of pipe friction and includes the net static head and the pressure drops through heat exchangers and other equip-

Table IV—Economic Pipe Velocities, Turbine Drive

Basis: Liquid flow in ft. per sec., using 3,600-rpm. turbine-driven pumps.

Nominal Pipe Diameter, In.	Specific Gravity of Liquid 0.50	0.75	1.0
2	7.0	6.0	5.5
3	7.6	6.6	5.9
4	8.0	7.0	6.3
6	8.5	7.4	6.7
8	8.8	7.7	7.0
10	8.9	7.8	7.1
12	9.0	7.9	7.1

Table V—Economic Pipe Velocities, Motor Drive

Basis: Liquid flow in ft. per sec., using motor-driven centrifugal pumps.

Nominal Pipe Diameter, In.	Specific Gravity of Liquid 0.50	0.75	1.0
2	10.7	9.2	8.4
3	12.0	10.3	9.4
4	12.9	11.1	10.1
6	13.9	12.0	10.9
8	14.6	12.6	11.4
10	15.0	13.0	11.7
12	15.2	13.2	11.9

ment plus the control valve drop. The friction factor may be assumed constant at 0.0045 for the range of velocities and pipe diameters under consideration. Variations in the friction factor resulting from variations in viscosity of the liquid are not of sufficient magnitude to affect the economic analysis except for the most viscous liquids.

The equivalent length of pipe for determining the line pressure drop is obtained from the following equation:

$$L_e = L\ (1 + 0.186\ D)$$

This relation was developed by assuming that the pump discharge line consists of 250 ft. of pipe, 20 bends, seven gate valves and one check valve. The equivalent length of pipe for a bend is assumed to be 20 pipe diameters; for a gate valve, seven diameters; for a swing-check valve, 110 diameters.

Results of these calculations are shown in Tables IV and V and Fig. 10.

Similar total cost equations can be set up by varying one by one each of the assumptions of the base cases. By comparing the economic velocities for these cases with the base cases, suitable correction factors can be developed.

CORRECTIONS FOR HIGH TEMPERATURES

Since extra-heavy pipe is often associated with high-temperature fluids, the pipe in these cases will generally be insulated. By assuming that extra-heavy pipe, 300-lb. ASA valves and 400-500 deg. insulation are used, instead of uninsulated, standard weight pipe, correction factors to Tables IV and V were calculated. For Case I (turbine-driven centrifugal pump) the correction factor is 1.17. For Case II (motor-driven centrifugal pump) the correction factor is 1.19.

Where alloy materials are used, the economic velocities should be somewhat higher than the velocities in Tables IV and V.

In Figs. 11, 12, 13, 14 and 15 are plotted correction factors to Tables IV and V for variations in cost of steam, ideal steam rate, cost of electricity, payout time and pump head. In evaluating the economic velocity for any liquid line, the value from Table IV or V is multiplied by each of the correction factors. This will give results of sufficient accuracy for sizing lines.

ECONOMIC BALANCES IN SIZING LIQUID LINES

The alternative to using economic velocities for sizing liquid lines is to make an economic study for each piping installation. Complex systems involving considerable investment and operating charges are best analyzed by this technique in order to obtain more accurate results. The procedure involves summing up the yearly costs of the piping and pumping installations and the yearly cost of utilities for two or three pipe sizes. The pipe diameter involving the minimum total cost is the correct economic size.

The advantage of such a study is in having the investment costs separated from the utilities costs. New plants are often designed on a basis of minimum initial investment cost. Expansions of old plants, on the other hand, may severely tax the facilities which furnish utilities, and in these cases emphasis may be placed on minimizing the consumption of utilities. If the total costs for two pipe sizes are comparable, it is possible to select the pipe size which will accommodate either of the requirements of minimum investment cost or minimum utilities consumption.

SAMPLE PROBLEM

This can be illustrated by means of the following example:

Problem—A charge pump and spare in an East Coast refinery feed 400,000 lb. per hr. of a 27.5-deg. API gas oil to a cracking unit. The feed passes through two sets of preheating exchangers in series. The first set consists of two shells in series, and the second set consists of two parallel banks of exchangers, each bank having two shells in series. The pressure drop through the exchangers totals 75 psi. A control valve on the pump discharge takes a 30-psi. pressure drop. The pressure at the inlet of the cracking furnace is 165 psig. The first set of exchangers heats the feed from 100 deg. to 300 deg. F., and the second set brings the temperature up to 500 deg.

Block and bypass valves are provided around each of the two shells in the first set of exchangers; block valves are provided for each bank of exchangers in parallel. Block valves are also included at the pump discharge and at the inlet to the furnace.

There are 125 ft. of pipe and three valves between the pump discharge and the first set of exchangers, 75 ft. of pipe and seven valves between the first and second set of exchangers, and 200 ft. of pipe and three valves between the second set of exchangers and the furnace.

The entire piping system must be designed for the pump shutoff pressure of approximately 325 psi., so that the valves will be 300 lb. ASA. However, standard weight pipe and fittings will be adequate for the service.

The initial 125 ft. of pipe will have no insulation, the 75 ft. of pipe between the exchangers will have 270-350 deg. F. insulation, and the last 200 ft. of pipe will have 400-500 deg. F. insulation.

In order to simplify the pressure drop calculations, these will be made at the average temperature of 300 deg. F.

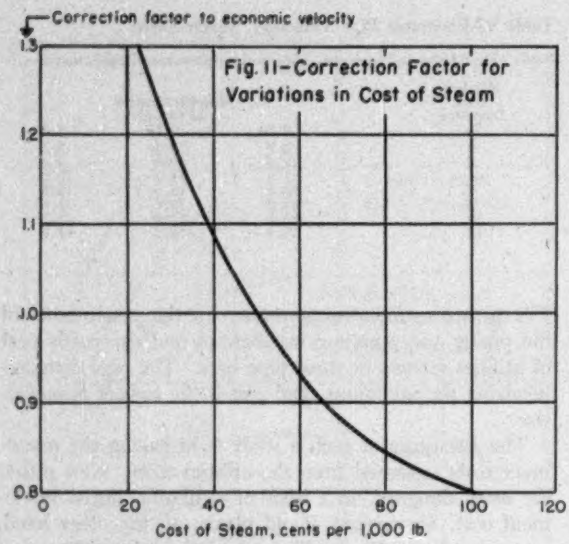


Fig. 11—Correction Factor for Variations in Cost of Steam

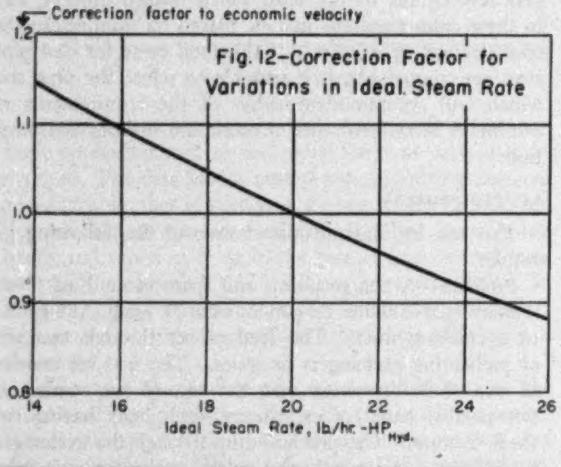


Fig. 12—Correction Factor for Variations in Ideal Steam Rate

The gas oil has a specific gravity of 0.8 and a viscosity of 2.0 cp. at 300 deg. F. The quantity of gas oil flowing at 300 deg. F. will be 1,010 gpm. and at 100 deg. F. it is 920 gpm.

Calculations of the economic pipe size will be made on the basis of a 2-year payout time for two cases:

(a) 3,600-rpm. steam turbine-driven centrifugal pumps with cost of live steam at $0.75 per 1,000 lb. and value of exhaust steam equal to $0.10 per 1,000 lb. Steam conditions are 150 psig. and 450 deg. F. at inlet and 20 psig. exhaust, for which the ideal steam rate (*ISR*) is 19.9 lb. per hp.-hr.

(b) Motor-driven centrifugal pumps with cost of electricity equal to $0.008 per kwh.

Solution—Calculations will be made for line sizes of 4, 6, 8 and 10 in., and the costs involved for each size will be compared in order to select the economic size.

Differential head on the pumps is determined as follows:

Pressure at inlet to furnace	= 165.0 psig.
Heat exchanger pressure drop	= 75.0 psi.
Control valve pressure drop	= 30.0 psi.
Pressure at pump discharge exclusive of pipe friction drop	= 270.0 psig.
Pressure at pump suction	= 0.0 psig.
Differential pressure head on pump exclusive of pipe friction drop	= 270.0 psi.

Table VI—Summary of Calculations for Sample Problem

Nominal pipe diameter, in.	4	6	8	10
Case A				
1. Velocity (1,010 gpm.), ft. per sec.	25.5	11.2	6.5	4.1
2. Pipe friction drop, psi. per 100 eq. ft.	19.0	2.5	0.70	0.23
3. Total pipe friction pressure drop, psi. = (400/100) (1 + 0.186*D*) (Item 2)	132.5	19.2	7.0	2.5
4. Differential head on pump, psi	402.5	289.2	277.0	272.5
5. Pump output, hydraulic horsepower = (Item 4) (920)/(1,714)	216.0	155.2	148.7	146.3
6. Cost of standard weight pipe and fittings, $ = (Table I) × 400/100	2,032	3,124	4,620	6,592
7. Cost of 300-lb. valves, $ = (Table II) × 13	2,280	4,040	5,960	8,310
8. Cost of insulation, $ = (Table III) (*L*/100) (1.35)				
270–350 deg. F. insulation = (Table III) (75/100) (1.35)	136	209	236	277
400–500 deg. F. insulation = (Table III) (200/100) (1.35)	583	720	1,090	1,293
9. Total cost of pipe and piping accessories, $	5,031	8,093	11,906	16,472
10. Yearly cost of pipe and piping accessories, $ per yr. = (Item 9) (0.06 + 1/2.0)	2,820	4,530	6,670	9,230
11. Cost of two steam turbine-driven centrifugal pumps = (Fig. 8) × 2	12,800	11,400	11,200	11,200
12. Yearly cost of pumps and drivers, $ per yr. = (Item 11) (0.06 + 1/2.0)	7,170	6,390	6,270	6,270
13. Yearly fixed costs, $ per yr. = (Item 10) + (Item 12)	9,990	10,920	12,940	15,500
14. Steam consumption, lb./hr. = (Fig. 4) (19.9)	13,350	10,300	9,650	9,550
15. Yearly cost of steam, $ = (Item 14) (8,150) (0.65/1,000)	70,800	54,600	51,100	50,600
16. Yearly fixed and operating costs, $ per yr. = (Item 13) + (Item 15)	81,790	65,520	64,040	66,100
17. Total investment, $ = (Item 9) + (Item 11)	17,831	19,493	23,106	27,672
Case B				
(Steps 1 through 10 are identical to Case A)				
11. Cost of two motor-driven centrifugal pumps, $	19,300	16,400	16,000	16,000
12. Yearly cost of pumps and drivers, $ per yr.	10,800	9,190	8,960	8,960
13. Yearly fixed cost, $ per yr. = (Item 10) + (Item 12)	13,620	13,720	15,630	18,180
14. Electric power consumption, KW = (Fig. 7)	212	156	150	148
15. Yearly cost of electricity, $ per yr. = (Item 14) (8,150) (0.008)	13,800	10,180	9,780	9,650
16. Yearly fixed and operating costs, $ per yr. = (Item 13) + (Item 15)	27,420	23,900	25,410	27,830
17. Total investment, $ = (Item 9) + (Item 11)	24,331	24,493	27,906	32,472

Calculations for the sample problem are detailed in Table VI and Fig. 16.* They indicate that for the specified conditions an 8-in. line size would be used with a steam turbine-driven centrifugal pump and a 6-in. line size would be used with a motor-driven centrifugal pump. In either case a 6-in. line size involves a $3,500 lower initial investment, but with a turbine centrifugal the yearly cost of steam would be $3,500 higher for the 6-in. line size as compared to the 8-in. line. With the motor centrifugal, the 6-in. line increases the yearly cost of electricity by only $400 over the cost for an 8-in. line.

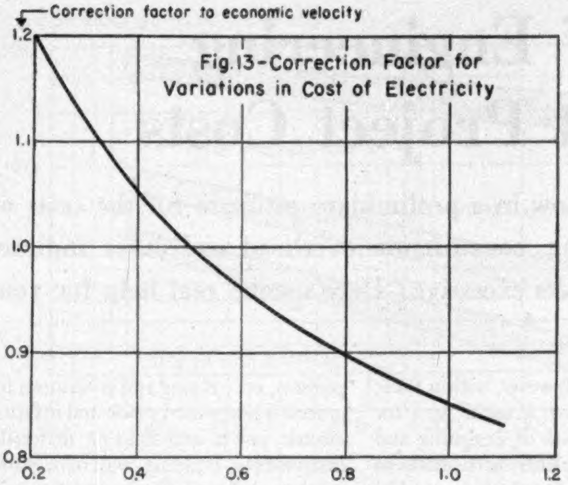
It is important to note that for the 6-in. size the yearly cost of steam for the turbine centrifugal pump is $54,600, against only $10,180 for the cost of electricity with the motor centrifugal pump. However, the investment cost for the latter is $24,493, as compared to $19,493 for the turbine centrifugal installation, a difference of $5,000.

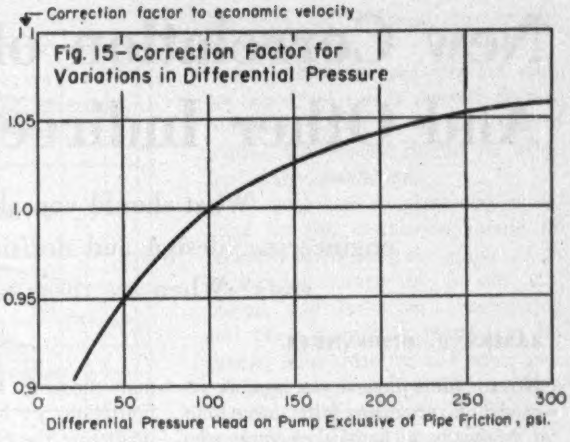
The economic line sizes for the sample problems could have been selected based on the velocity data in Tables IV and V:

Case A—Economic velocity from Table IV for specific gravity = 0.8: 6-in. size = 7.3 ft. per sec.; 8-in. size = 7.6 ft. per sec.

Correction factor for cost of steam at $0.65 per 1,000 lb., from Fig. 11 = 0.90. Correction factor for ideal steam rate, from Fig. 12 = 1.0. Correction factor for

* In Fig. 16 Curve A-1 refers to Case A investment, A-2 to yearly cost of steam, A-3 to total yearly fixed and operating costs. Curves B-1, B-2 and B-3 are the corresponding values for Case B.





payout time of two years, from Fig. 14 = 1.0. Correction factor for differential pump head, from Fig. 15 = 1.06. Correction factor for use of 300-lb. ASA valves plus insulation on some of the line = appr. 1.10.

Corrected economic velocities: 6-in. size = (7.3) (0.90)(1.06)(1.10) = 7.7 ft. per sec.; 8-in. size = (7.6) (0.90)(1.06)(1.10) = 8.0 ft. per sec.

Referring to Table VI, Line 1, it is readily seen that a 6-in. line with an economic velocity of 7.7 ft. per sec. will not handle the required 1,010 gpm., whereas an 8-in. line will be more than adequate.

Case *B*—Economic velocity from Table V for specific gravity = 0.8: 6-in. size = 11.8 ft. per sec.; 8-in. size = 12.8 ft. per sec.

Correction factor for cost of electricity at $0.008 per kwh., from Fig. 13 = 0.90. Correction factors for payout time, differential pump head, valves and insulation are the same as Case A.

Corrected economic velocities: 6-in. size = 12.4; 8-in. size = 13.5.

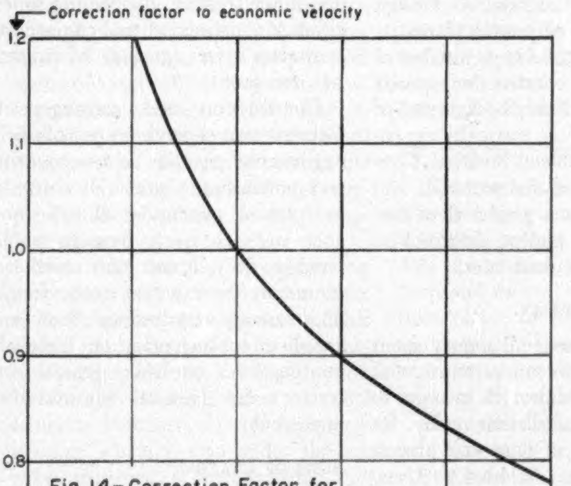
Again referring to Table VI, Line 1, the required velocity is 11.2 ft. per sec. Since the 6-in. line shows an economic velocity of 12.4, it is adequate.

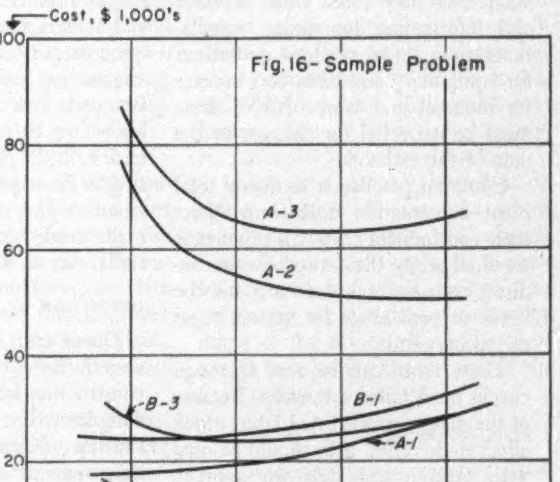
In both cases the pipe size selections made by this method agree with those made by the previous method.

The most accurate procedure here would be to plot on a single graph a curve showing the economic velocity vs. pipe diameter, similar to those of Fig. 10 but corrected for the particular conditions which apply, and another curve of required velocity vs. pipe diameter. Where the two curves intersect is the economic diameter.

ACKNOWLEDGMENT

The authors wish to acknowledge the work of Mr. R. Bussolori in making the calculations for the tables of economic velocities. The basic cost information included in this article has been furnished by and is published with the consent of Foster Wheeler Corp., who reserves republication rights.





New Correlation of Engineering And Other Indirect Project Costs

What should you allow in a preliminary estimate for the costs of engineering, design and drafting, construction overhead and other indirect costs? When are these costs excessive? Here's some real help for you.

JAMES P. O'DONNELL

NOTE: More than a year ago we received an interesting letter from John J. Mahoney, a chemical engineer who had been following our series of articles on cost estimation. He pointed out that published data were lacking on a very important phase of cost estimation—the costs of engineering, design and drafting, and other indirect project costs.

We went to work on John for such an article; he, in turn, sold his boss, Jim O'Donnell, on the idea. You are now looking at the result.—EDITOR.

COST estimates for construction projects are usually made by listing all costs expected from the start of project design (after preliminary process development has frozen the specific process scheme) until the day of production start-up.

If there is sufficient time to make a detailed estimate, the supporting data for all costs can be fairly complete. Such data may come from previous cost information for similar installations, from actual vendors' quotations for equipment, and from cost indexes for material and labor. All of these must be corrected for changes to the date of the estimate.

Common practice is to divide total plant construction costs into direct costs and indirect costs. In this article we shall study the ratios of some indirect costs to total plant cost and the limits of such ratios for various types of process plants.

These ratios can be used as rough checks on detailed estimates. Because of the many factors, listed later, which affect these ratios, they should be used with caution and only for approximate checking. However, within these limitations we have a useful tool for predicting the costs of designing and building process plants, particularly in the chemical and petroleum industries.

There's a further benefit to be gained from a knowledge of these ratios of indirect costs to plant cost—correcting the tendency to underestimate the indirect costs of process plants. This underestimating is more prevalent in the early stages of planning; it may be due to some extent to the relatively lower percentage fees of engineers, architects and general contractors for conventional industrial buildings or for routine expansions to power plants or other utilities.

Such projects must be considered in a separate category from the modern, complex, continuous process plant designed for safe, trouble-free, round-the-clock operation with low operating and maintenance costs and under control of automatic instruments. Design and construction of process plants require the services of a large number of engineering and construction specialists, each with a heavy background of know-how based on particular experience with the problems involved. Contingencies required for materials and labor are also much greater than normally needed for routine industrial installations, as discussed later.

JAMES P. O'DONNELL heads the firm of project engineers bearing his name. He is located at 39 Broadway, New York.

DEFINITION OF TERMS

Direct costs cover all money spent directly for equipment, materials, and construction labor payrolls in order to complete the installation ready for start-up. (Costs of land and process development are excluded.) Usual items of direct cost are:

Process equipment, such as towers, tanks, pressure vessels, heat exchangers, condensers, heaters, stills, mixers, agitators, dryers, filters, pumps, compressors, etc.; piping and accessories for process fluids, water, steam and utilities; electric power and lighting materials; instruments; building materials; structural steel; foundation materials; insulation and refractory materials; paint and miscellaneous materials; construction labor payrolls.

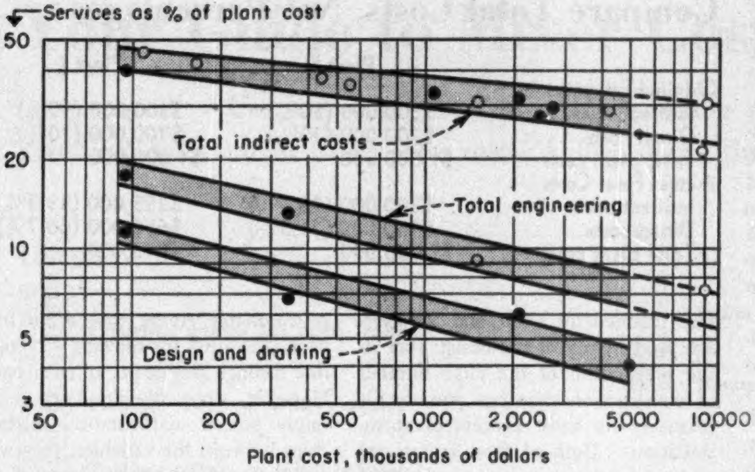
Indirect costs cover the balance required to make up total plant cost. They can be grouped under (a) total engineering and (b) construction and contingencies. Following is a typical list of items of indirect cost.

Total engineering: Engineering productive payroll; purchasing productive payroll; design and drafting productive payroll; expediting-inspection productive payroll; all payroll overhead, including holiday-sickness costs, vacation and standby costs, Social Security and compensation costs, public liability and other insurance, general office service costs, blueprints and supplies, heat, rent, light, legal, accounting, miscellaneous; engineering supervision of construction; and engineering contractor's fee (general administrative and profit).

Construction and contingencies: Construction supervision payroll; field engineering payroll; field accounting and purchasing payroll; all construction payroll overheads; all risk insurance costs (property damage, public liability, fire); home office overhead; temporary construction costs; freight and cartage; construction tools and supplies; contingencies on materials; contingencies on labor; general contractor's fee (general administrative and profit).

BASIS OF GRAPH

The upper band of the graph shows the ratio of indirect costs to plant cost. Plotted points are based on data from completed plants and also from job estimates for plants.



CORRELATION of indirect costs with total plant cost. Solid points are from records of jobs actually constructed; open points are from detailed job estimates.

Principal source of these points is the data published by Lang (*Chem. Eng.*, Oct. 1947, pp. 117-121), with an added correction for general contractors' fees. Percentages added for such fees range from 4 percent of plant cost (before fee) in the $5,000,000 range to 10 percent in the $100,000 range. Supplementing Lang's data are points from jobs and estimates in the author's files. The points used apply to continuous process plants handling a wide variety of chemicals, including fatty acids, gasoline and petroleum products, synthetic rubber, synthetic detergents, insecticides, etc.

The two lower bands on the graph are intended only as guides in setting up approximate budgets for total engineering and for design and drafting. Each of these bands is plotted with a proportionate share of overhead and engineering contractor's fee added to payroll costs. Points plotted are based principally on engineering costs in the author's files for completed jobs, supplemented by points for total engineering from clients' data.

Note that the item of engineering supervision of construction has been included under total engineering. This should not be confused with construction supervision, which is the function of the job superintendent or construction manager, or with field engineering, which is also under the job superintendent. It represents the very important function of inspection and review of the construction to check on adherence to the engineering drawings and specifications.

This engineering supervision is best performed by a representative of the design staff because of his intimate knowledge of the design basis. Such a representative can promptly evaluate substitutions requested by the field in specifications or drawings and make decisions in the owner's best interest. The continuity of the engineer's responsibility through the construction and initial operating phases of a job is very worthwhile.

Design and drafting include all layouts, calculations and design work directly related to the preparation of construction drawings, bills of materials, and materials specifications for piping, structural steel, concrete, etc. Engineering supervision of design and drafting, preparation of equipment specifications for procurement, and similar general engineering services are excluded from design and drafting, but included under total engineering.

USE AND LIMITATIONS OF GRAPH

The graph is to be used with caution and judgment so that it is not extended beyond the limits of the data upon which it is based. The author [and editors] would welcome data from others to extend the usefulness of this graph beyond its present limits, or data which show inconsistencies limiting its usefulness.

The author believes that the plotted data reasonably support the use of the upper band of indirect cost percentages for plant costs between $100,000 and approximately $5,000,000. For plant costs above this range, the points are based on estimates; the user should exercise caution until further supporting data are obtained from other sources.

All installation and erection costs are based on plants erected or proposed for erection in the United States. Corrections should be made for foreign installations.

All costs used in plant cost as defined for this correlation should be included when using the graph. If an engineering contractor is not employed, add to owner's engineering and other payrolls a percentage for general administrative and other payroll burden. Also, in estimating construction costs do not overlook contractor's fee. Most important of all, do not overlook contingencies for unforeseen items of materials and labor and for increases in unit costs of equipment, materials and labor during the full expected period of engineering and construction.

The graph is intended only for continuous process plants, principally handling fluids, or solids and fluids in combination, with full automatic instrumentation. The plants are "one-of-a-kind" type. If two exact duplicate plants are required, or even if one plant largely duplicates another, corresponding reductions in the percentage indirect costs should be made.

The graph is not to be used for separate installations of petroleum or chemical marketing terminals, boiler plant installations or similar utility facilities for process plants. A group of four such completed installations in the author's files show total engineering at approximately half the cost indicated on the graph. These four plants ranged from $700,000 to $1,400,000 total cost. The graph may, however, be used when complete process plants include normal tankage.

Judgment must be exercised in deciding whether to use the lower, middle or upper portion of the bands. Each factor which tends to increase indirect costs and which may be present during the design or construction stages of the project should be given weight in selecting the portion of the band to use.

FACTORS AFFECTING INDIRECT COSTS

Considering the many factors which can change the indirect costs on particular jobs, a spread would be expected in the indirect costs/plant cost ratio, as indicated on the graph. Some of these factors are:

Design Complexity—Continuous process plants range from simple distillation tower installations with routine heat exchange, condensing and pumping equipment to processes involving many operations in one installation, such as filtering, absorption, refrigeration, evaporation, drying and catalysis. On many jobs revisions in basic design data, usually to increase throughput, are made during the design, or even in the construction phase.

Contingencies on Materials and Labor—These items (which in this article are defined as indirect costs) can vary widely for many reasons, such as unforeseen foundation problems, difficult procurement problems requiring substitutions at extra costs beyond the estimate, high labor costs because of strikes or lack of skilled labor in the area, and rising equipment and materials costs during the procurement and construction period.

Materials of Construction—Use of alloys or other special materials for equipment and piping will affect the relationship between indirect costs and plant cost. Substitution of more expensive materials of construction on installations where special design is not thereby required will tend to reduce the ratio of indirect costs to plant cost. In other cases the ratio may increase if additional engineering problems are introduced by virtue of the use of special materials of construction.

Calendar Period for Completion—Where only a short calendar period is available for engineering, procurement and construction, costs are considerably increased. If the schedule for engineering and design is so short that complete details of construction procedure are replaced by notes such as, "Field to install for existing conditions," costs are usually greater. Original design layouts or revisions to layouts are almost always much less expensive when made in the engineering and design stage than under rush conditions during construction. A further element of cost increase on short calendar schedules is premium time for construction labor.

SALARIES AND PRODUCTIVITY

Two important factors determining costs of total engineering and design and drafting are the average salary levels for the engineering and design staff required for a job, and the average productivity of the design staff in the preparation of the large number of construction drawings and details necessary for most process plant installations. Both of these factors are affected by the complexity and size of the installation.

Where the plant is small, but requires much basic layout and preliminary engineering and a minimum of routine drafting, the average cost of engineering and design on an hourly basis will be relatively high. On large installations with a less complex design there is an appreciable cost reduction, particularly in the design and drafting, as more lower salaried personnel can be used.

The total engineering graph is based on an approximate range of \$6.50 to \$8.50 per hour cost to the owner for engineering. The design and drafting graph is based on a range of \$4.50 to \$6.50 per hour cost to the owner. (Both cost ranges are corrected to a June 1952 basis.) The costs to the owner for engineering and design, as noted above, are not payroll costs only, but include overhead and fees.

The average productivity for design and drafting, measured by hours per construction drawing, ranged from about 95 to 115. These figures are based on all types of drawing required for a job; there is considerable variation in the time required for each type of design, such as structural, architectural, mechanical and piping, electrical power and automatic instrumentation. Included in the activities on which this average productivity is based are all preliminary layouts, design calculations and revisions due to changes for any reason.

LINE VS. BAND

In this article the autnor has intentionally placed strong emphasis on the limitations of the graph because of the nature of the variables plotted. A reasonably strong case could have been presented for drawing a straight line through the center of each band. However, since straight lines might imply precise mathematical relationships between the variables, they were not used. For process plants of the same type in a particular industry, the bands of indirect costs should be very narrow due to the elimination of some of the variables.

Compare Total Costs, Not Percentages

	Plant 1	Plant 2
Original Estimates		
Indirect costs	\$300,000 (30%)	\$300,000 (30%)
Direct costs	\$700,000 (70%)	\$700,000 (70%)
Total plant costs	\$1,000,000	\$1,000,000
Actual Final Costs		
Indirect costs	\$300,000 (28.5%)	\$325,000 (33.3%)
Direct costs	\$750,000 (71.5%)	\$650,000 (66.7%)
Total plant costs	\$1,050,000	\$975,000

COSTS VS. PERCENTAGES

In analyzing costs of engineering and other indirect services required to design and construct process plants, don't jump to conclusions from incomplete cost data.

For example, a low ratio of indirect costs to final plant cost on a job does not necessarily indicate that it was built at lowest total cost. This is because additional indirect costs for more complete analyses of process requirements, for more complete mechanical engineering and design or for closer supervision of construction frequently save more in direct costs for materials and labor than the extra cost of services. There is often a further bonus in earlier plant completion.

Consider the two possible cases in the table. Assuming that the two plants are comparable from the standpoint of meeting production goals and for operating and maintenance costs, the better job would be Plant 2, costing \$75,000 less than Plant 1.

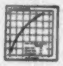
If a superficial analysis were made of indirect costs on the two jobs, it might be concluded that the performance of engineer, contractor and others involved in indirect costs were not as satisfactory on the job which saved the owner \$25,000 of the estimated cost. Of course, the fallacy is due to a concentration of attention on the item of indirect costs (which in Plant 2 overran the estimate by \$25,000) and overlooking the \$50,000 saved in final direct costs.

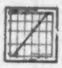
Your Guide to Mixer Costs

Use it to ease your chore of preparing pre-design estimates. Costs are given on an installed basis. The roster below shows the types of equipment covered.

LIQUIDS


Propeller mixers for open tanks


Portable steel propeller mixers


Turbine mixers in stainless steel

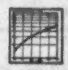
SOLIDS


Spiral ribbon mixers for blending


Rotary double cone dry blenders

SEMI-SOLIDS


Double arm jacketed sigma mixers


Two roll mills, heated or cooled


Extruders with variable drives


Muller type mixers in mild steel

MISCELLANEOUS


Planetary action vertical mixers


Colloid mills in stainless steel


Installation costs vs. horsepower

GEORGE E. LEWIS

The subject of mixer costs necessarily leads to consideration of a great variety of equipment to handle the many types of liquids, solids and semi-solids currently being processed by the chemical and allied industries. The purpose of this article is to present cost data which are suitable for pre-design estimating on the more common types of mixers.

It should be borne in mind that many mixing operations require a non-standard construction of mixing equipment. This fact is illustrated by the great number of manufacturers who state that all their mixers are custom built; therefore they cannot supply average costs, but can only quote on equipment required for a particular use.

The pre-design estimator usually cannot wait for development of quotations and, in fact, frequently does not have available the detailed specifications on which quotations are normally based. The accompanying cost curves and capacity tables are presented for the use of such pre-design estimators.

Table I—Solids Blending Equipment

Driver Horsepower	Working Capacity: Spiral Ribbon Mixers, Cu. Ft.	Working Capacity: Rotary Blenders, Cu. Ft.
3	7–10	10–20
5	15–20	30–40
7.5	25–30	50–60
10	40–50	75–100
15	55–70	125–150
20	85–100	200–250
25	125–150	
30	200–300	
40	400	
50	500	

In compiling the data it was considered advantageous for pre-design purposes that the costs be presented on an "installed" basis. In most cases costs shown are based on the average purchase price of similar equipment from two or more manufacturers. To this has been added installation cost with the *Engineering News Record* Construction Cost Index adjusted to 600. The resultant figures have been plotted against driver horsepower and the best smooth curve drawn through the data.

Materials of construction and motor types are also listed. In addition, a general curve for self-contained, electrically-driven equipment shows the relationship between driver horsepower and average installation cost.

The estimator will recognize that costs for unusual mixer requirements may be quite different from the costs presented here. This should be taken into account when estimates are made.

SOLIDS MIXING EQUIPMENT

Examples of types of equipment suitable for blending dry, free-flowing solids are spiral-ribbon mixers and rotary mixers such as double-cone blenders. Horsepower requirements for varying sizes of equipment are given in Table I.

SEMI-SOLIDS MIXING EQUIPMENT

Two-roll mills, double-arm sigma mixers, extruders, and mullers fall into this category. Types of materials handled include high viscosity pastes, plastics, and elastomers. Roll mills, extruders, and sigma mixers are frequently used to break down molecular structures of high molecular weight

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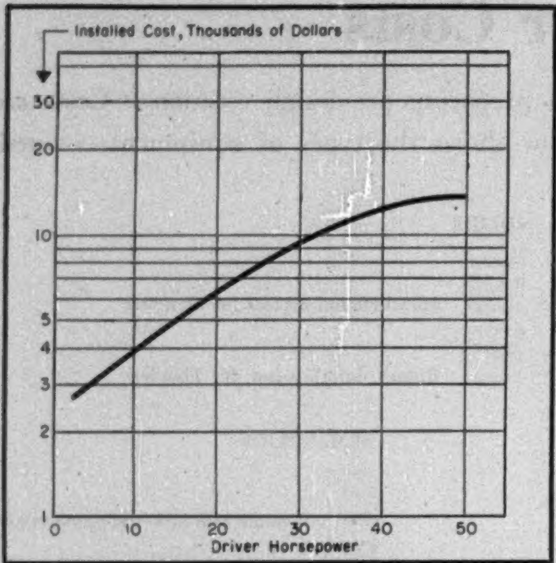
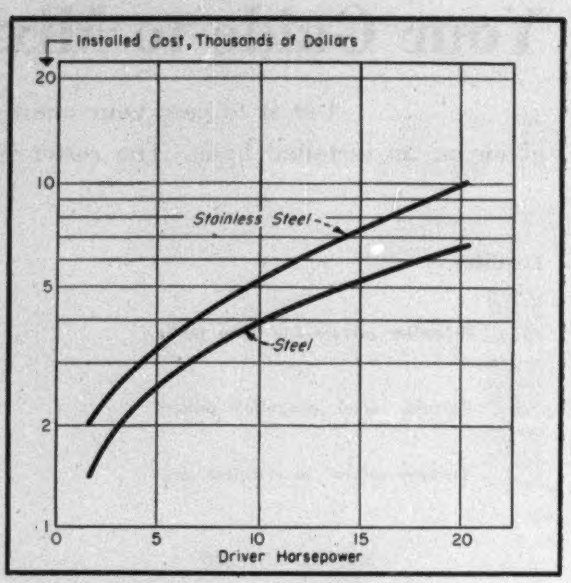
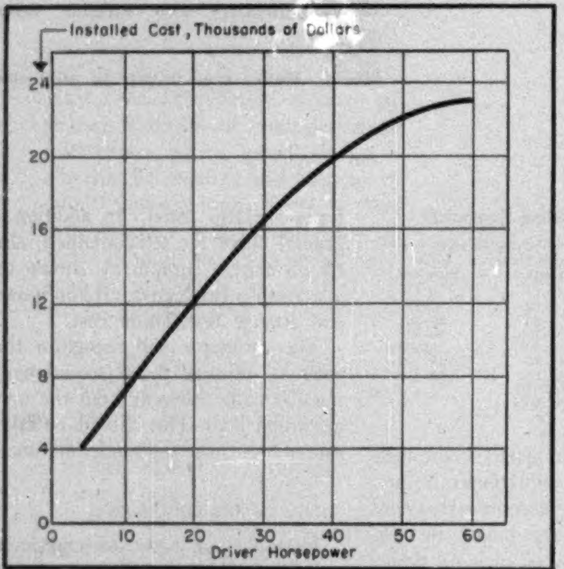


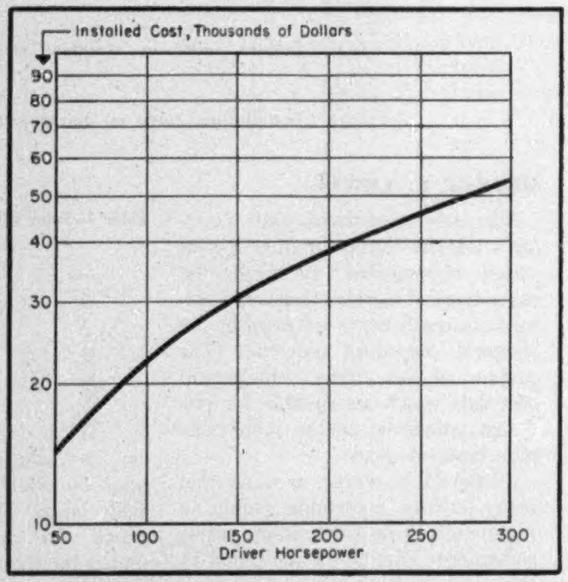
SPIRAL RIBBON MIXERS
These dry blender costs include Class 1 Group D motors.



ROTARY DOUBLE CONE BLENDERS
Totally enclosed motors are included with these blenders.



DOUBLE ARM SIGMA MIXERS
Jacketed, non-vacuum steel units with Class 1 Group D motors.



TWO ROLL MILLS
Include totally enclosed motors and electrical equipment.

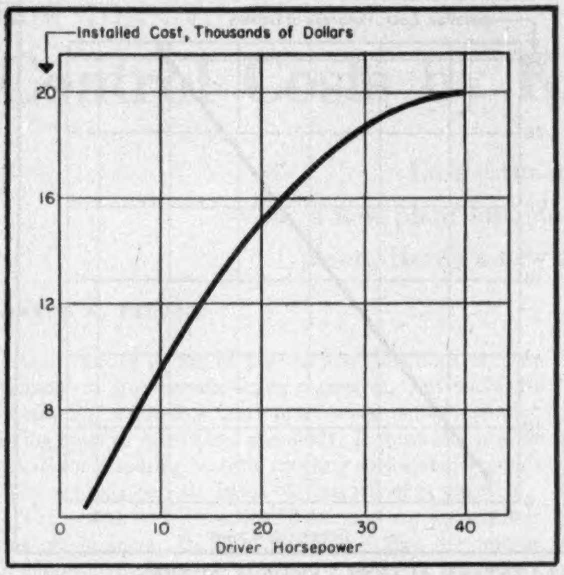
materials simultaneously with the incorporation of pigments, plasticizers, fillers, etc. The choice of equipment frequently depends upon the type of process and final form of the mixed material.

Extruders are employed for continuous processing and can be used to form the product into desired shapes such as ribbons, tubes or rods. Roll mills discharge the stock in sheet form. It is not uncommon to use a roll mill in combination with a double-arm sigma mixer where the sigma mixer is used for processing followed by the roll mill to sheet the product.

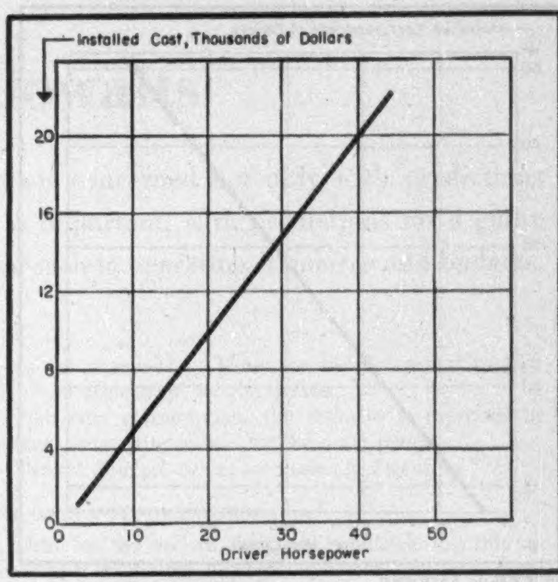
Table II–Sizes and Capacities for Semi-Solids Mixers

Driver Horsepower	Mullers, Working Capacity, Cu. Ft.	Sigma Mixers Working Capacity, Gal.	Two-Roll Mills, Dia. x Length, In.	Extruders: Screw Dia., In.	Extruders: Nominal Cap., Lb.-Hr.
1.5	0.5				
3		2.5		1.5	30-35
5	4	5			
7.5	6	10		2.5	60-90
10		15	8 x 18		
20	15	50		3.5	125-150
40	30			4.5	250-300
50		100			
75		150	20 x 40		
150			22 x 60		
250			26 x 84		

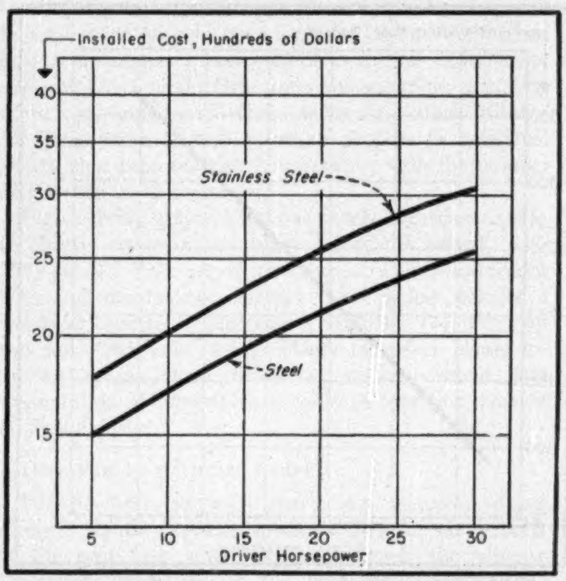
No completely satisfactory basis is available for tabulating the capacities of these mixers because capacity is de-



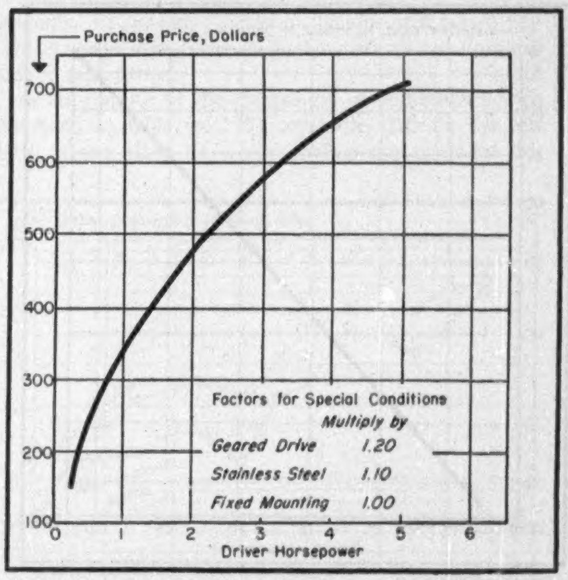
EXTRUDERS
These units have steel cylinders and variable speed drives.



MULLER TYPE MIXERS
Constructed of mild steel, include open motors.



PROPELLER MIXERS
Top entering for open tanks with Class I Group D motors.



PORTABLE PROPELLER MIXERS
Mild steel construction, Class I Group D motors.

pendent to such a large extent on viscosity and other physical characteristics of the mix.

Table II gives a rough idea of the physical size of the equipment.

LIQUID MIXING EQUIPMENT

The most common types of mixing equipment for light and medium viscosity liquids are propellers, turbines, and paddles. For materials with viscosities close to that of water, the horsepower requirements for good batch mixing are given in Table III.

OTHER TYPES OF MIXERS

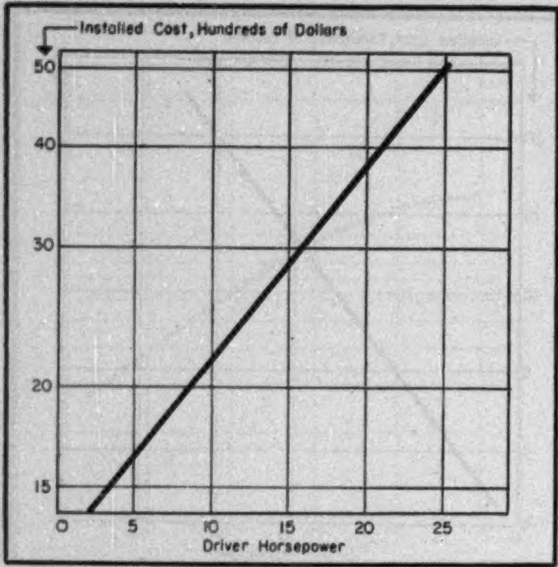
There are a great number of special single purpose mixers on the market. Perhaps the most important of these are pieces designed to produce emulsions or suspensions. Samples of such equipment are colloid mills and planetary action vertical mixers of the egg beater type. Colloid mills are nor-

Table III—Liquid Mixers

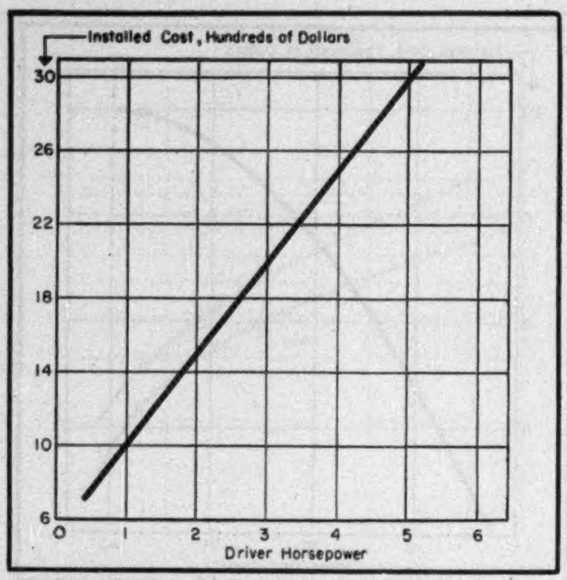
Driver Horsepower	Working Capacity, Gal.
3	200-1,000
5	1,000-1,500
7.5	1,500-2,000
10	2,000-3,000

Table IV—Colloid Mills and Planetary Action Vertical Mixers

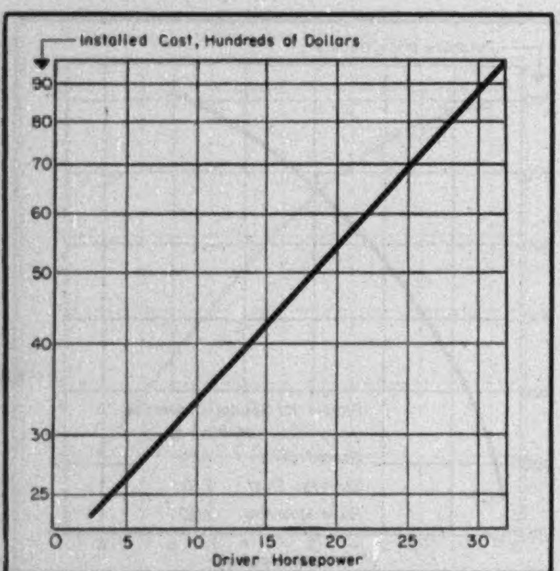
Driver Horsepower	Vertical Mixers Vessel Size, Gal.	Colloid Mills Capacity, Gph.
0.5	4-8	
1	8-15	
2	8-20	
3	10-30	20-50
5	20-45	
7.5		50-100
20		100-400
50		400-1,000
75		1,000-5,000



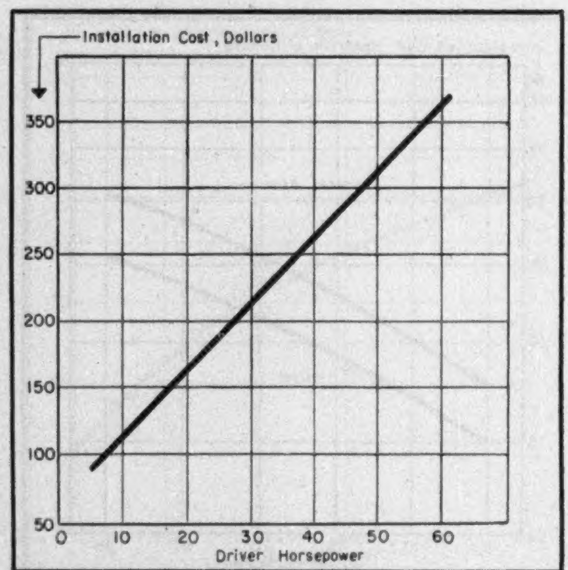
TURBINE MIXERS
Stainless steel construction, Class I Group D motors.



PLANETARY ACTION VERTICAL MIXERS
Totally enclosed motors are included in the costs.



COLLOID MILLS
Stainless steel construction, Class 1 Group D motors.



INSTALLATION COSTS
Cover self-contained electrically-driven equipment.

mally used for continuous processing while the vertical mixers operate batchwise.

INSTALLATION COSTS

Although the costs are presented on an installed basis, the pre-design estimator occasionally finds it necessary to add installation costs to a vendor's price for a given piece of equipment. Therefore, we have plotted driver horsepower against average installation cost for self-contained electrically driven equipment. The cost figures include millwright labor to set and grout the equipment, starter, switch, conduit, wire and electrical labor, as well as material and labor for a nominal amount of cooling water and steam piping.

Again, special conditions frequently add to the cost. Values derived from this graph do not provide money for abnormally long service lines, special ventilation requirements or foundation pads.

ACKNOWLEDGMENT

Assistance and cooperation of the following concerns were most helpful in compiling the information presented in this report: Farrel-Birmingham Co., Admiral Tool and Die Co., The Safety Car Heating and Lighting Co., Wm. R. Thropp & Sons Co., Read-Standard Corp., National Engineering Co., Mixing Equipment Co., National Rubber Machinery Co., Modern Plastics Machinery Co., Patterson-Kelley Co.

HOW TO . . .

Control Costs by Kilowatts

Cost estimation is concerned not only with predictions for a new plant but, just as important, with predictions for a going plant. Here's a new approach to operating standards and budgets.

DAVID E. PIERCE

Cost control is one of the essential functions of management in any manufacturing enterprise. Any successful system for controlling costs must relate actual manufacturing costs to established standards. It must also provide means for preparing budgets covering anticipated expenditures in future periods, based on forecasts of production.

The system to be described here is a new approach to this old problem. Its basic principle is that the amount of energy consumed in a plant is a measure of that plant's activity.

The validity of this common denominator in relation to maintenance costs has been shown in previous papers.* Its application has now been extended beyond the original field of maintenance cost control to include other major items of direct production cost—raw materials; operating labor; consumption of steam, water and other utilities. All these items, as well as others peculiar to individual plants, have been correlated successfully with the number of kilowatt-hours consumed.

Fig. 1 shows graphically how closely the consumption of electric power in one plant during the period 1932-1945 paralleled the use of steam, water, acid, maintenance labor and maintenance material. That period included a variety of conditions—depression, normalcy (?), recession and war—and since similar charts for other plants exhibited equally close correlation, it was evident that consumption of kilowatt-hours could be used as a measure of plant activity.

PREPARATION OF STANDARD CURVES

For practical purposes, curves are generally drawn through points representing actual data for all quarters of the past four years. For each graph the abscissa (arithmetic scale) covers the total range of quarterly electric power consumption in the plant, expressed as actual kwh. divided by a power of ten. The ordinate (logarithmic scale) is the quarterly unit of cost or of hours of labor in consistent units.

In the case of steam consumption, the ordinate is pounds of steam per kilowatt-hour in each period and the abscissa is the corresponding degree-days for those periods. For each day, the number of degrees below 65 deg. F. gives the degree-days. These are added together to give the total degree-days for the quarter.

For water consumption, the ordinate is expressed as average water temperature for the same period.

Typical standard curves are shown in Figs. 2 to 7.

USE OF CURVES FOR CONTROL

Data for the various items are tabulated monthly as received from the accounting department. For each quarter the results are compared with the values predicted by the standard curves for the actual kwh. consumption. Deviations are expressed as percentages of standard amounts. In general, a deviation of plus or minus 6 percent is within the precision of the method and does not require explanation.

As an example of the comparison of performance with standard, the table (p. 196) covers the data for the year 1950 in one plant. It is seen that in this plant for this

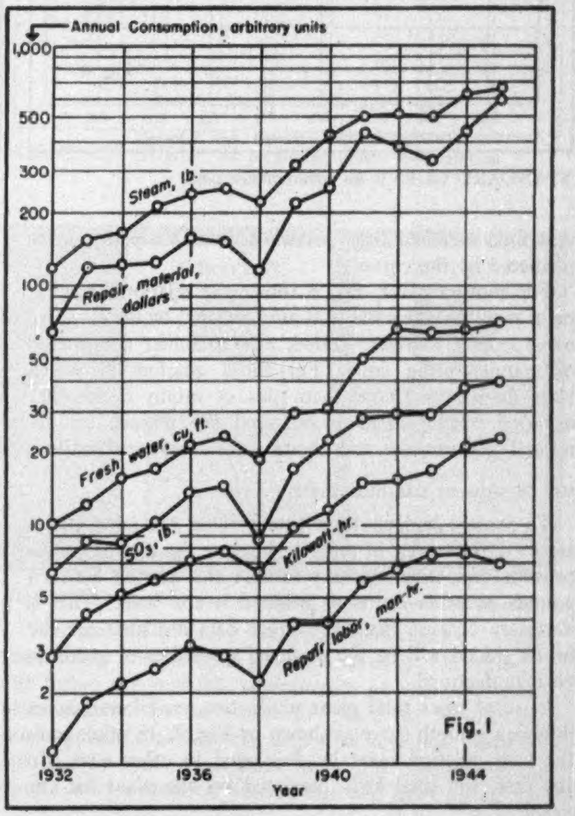
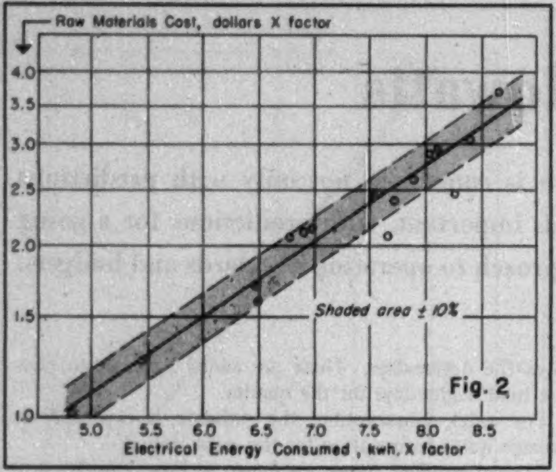


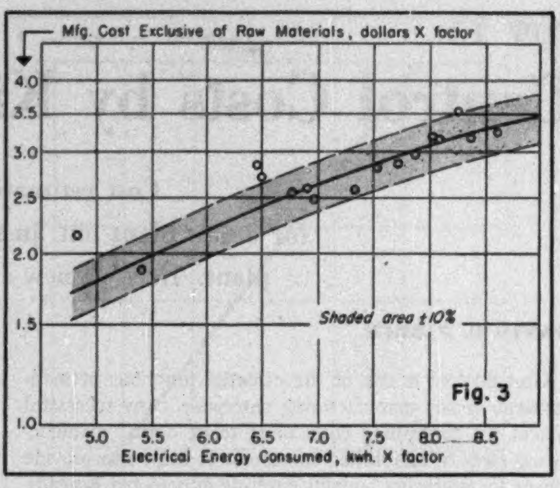
Fig. 1

* *Chem. Eng. Prog.*, March 1948, pp. 249-252; *Factory Mgt. & Maint.*, Aug. 1948, pp. 78-86; "Techniques of Plant Maintenance," pp. 139-145, Clapp & Pollak, New York, 1951.

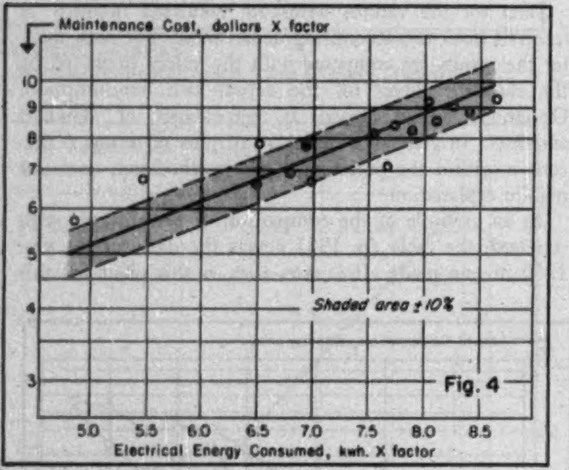
D. E. PIERCE *is chief engineer for General Aniline & Film, New York. Author of the McGraw-Hill book, "Chemical Engineering for Production Supervision," he is also engaged in part-time consulting work.*



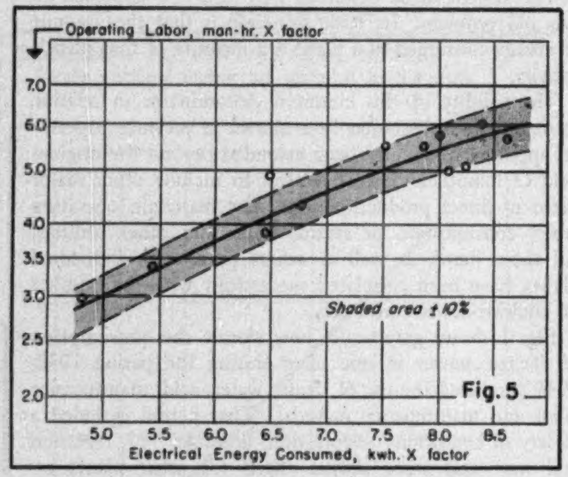
STANDARD CURVE for raw materials cost.



STANDARD CURVE for cost exclusive of raw materials.



STANDARD CURVE for maintenance cost.



STANDARD CURVE for operating labor man-hours.

year there were no large deviations from the performance predicted by the curves.

For another plant, Fig. 8 shows the relation of actual plant maintenance costs to those predicted by the standard curve over a four-year period; also a similar comparison of manufacturing costs. For those quarters in which large deviations (more than plus or minus 6 percent) occurred, management investigated the reasons for abnormal performance and found satisfactory explanations.

USE OF CURVES FOR BUDGETING

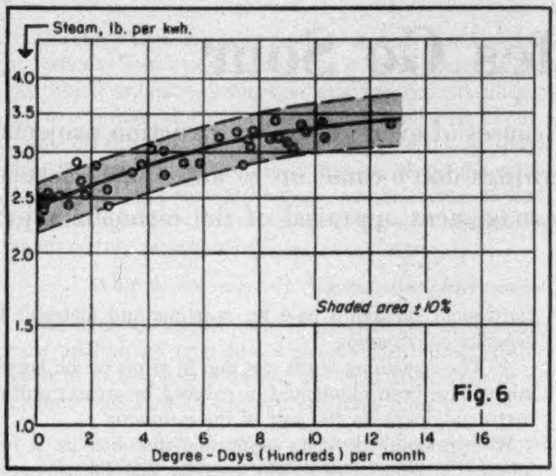
To prepare budgets for future periods, the same curves are used. However, in order to forecast the electric power consumption, it is necessary to have the relation between pounds or other units of production and kwh. This is necessary because the only direct data available for the future period will be the expected quantities of goods to be manufactured.

In some cases total plant production vs. kilowatt-hours follows a smooth curve as shown by Fig. 9. In other cases the kwh. relation must be developed in other ways. In any case, the total kwh. predicted for the plant for any

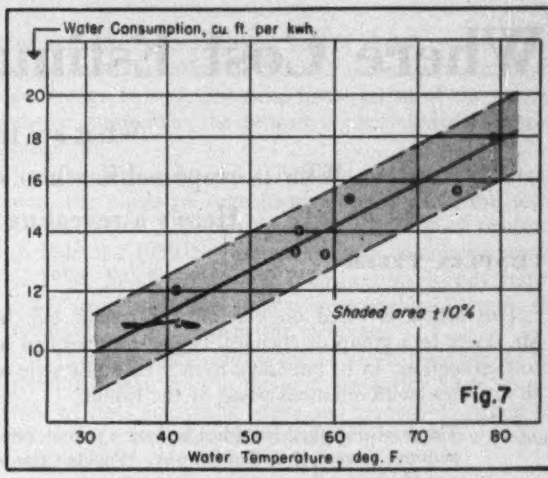
How One Plant's Performance Compared With Standard

	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Total
Kilowatt-hours........	677	787	645	838	2,947
Raw material cost					
Predicted, $........	192	273	174	323	962
Actual, $..........	206	262	171	306	945
Deviation, %.....	+7.1	−4.1	−1.7	−5.2	−1.8
Mfg. cost excl. raw material					
Predicted, $.......	254	311	238	338	1,141
Actual, $..........	258	302	237	323	1,120
Deviation, %.....	+1.7	−3.0	−0.6	−4.5	−1.9
Maintenance cost					
Predicted, $.......	705	871	667	954	3,197
Actual, $..........	701	834	673	899	3,107
Deviation, %.....	−0.6	−4.2	+0.9	−5.8	−2.8
Operating labor					
Predicted, hr......	440	524	414	559	1,937
Actual, hr.........	437	549	386	598	1,970
Deviation, %.....	−0.7	+4.8	−6.8	+7.0	+1.7
Steam consumption					
Predicted, lb......	216	208	158	247	829
Actual, lb.........	217	200	144	240	801
Deviation, %.....	+0.5	−3.8	−8.9	−2.8	−3.4
Water consumption					
Predicted, cu. ft...	785	1,120	1,090	1,150	4,150
Actual, cu. ft......	751	1,049	1,010	1,190	4,000
Deviation, %.....	−4.3	−6.2	−7.3	+3.5	−3.9

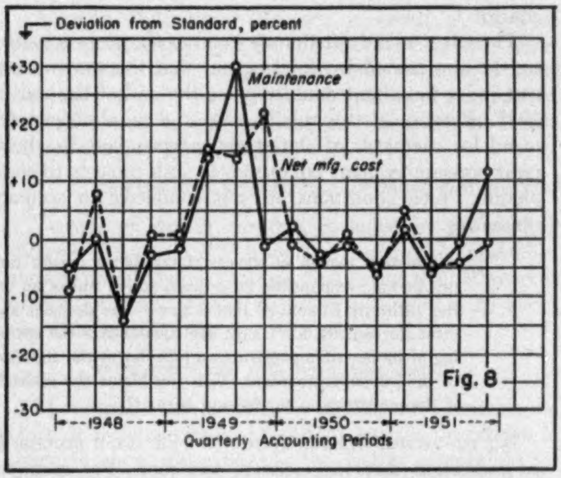
Note: All units of consumption have been divided by factors.



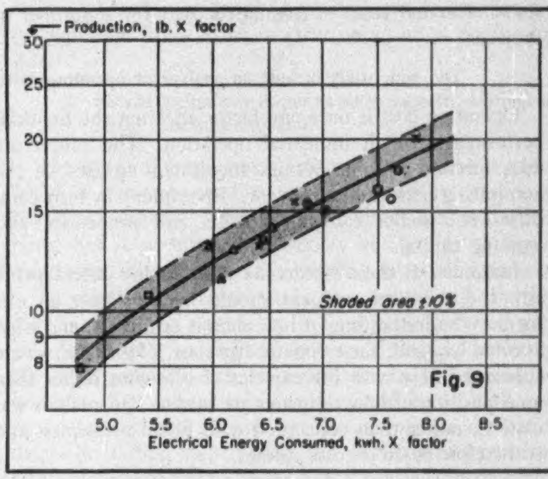
STANDARD CURVE for steam consumption.



STANDARD CURVE for water consumption.



DEVIATIONS from standard in actual plant performance.

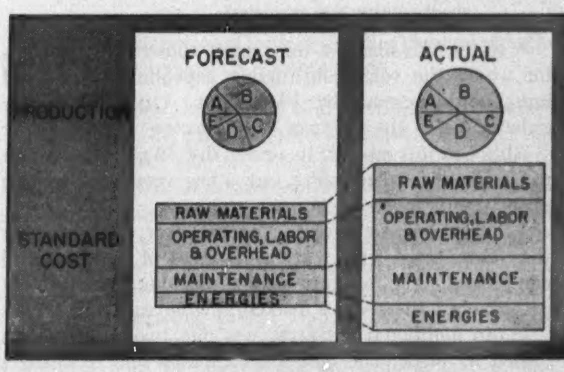


STANDARD CURVE for predicting power consumption.

future calendar period is used in turn to predict the various items of cost and the anticipated requirements for labor, steam, water, etc., in the period under consideration.

The over-all problem may be summarized graphically by the chart at the right. The circle at the upper left represents the total plant production expected in a given quarter of the next year. The pattern of production is represented by the individual sectors within the circle, each being weighted according to the projected number of pounds of that item to be produced. From the expected production the corresponding consumption of electric power is determined, and the various items of cost are forecast from the variable budget curves.

When the quarter in question has come and gone, actual performance is compared with standard. Appropriate steps are taken to investigate deviations and to institute corrective measures where necessary. In case the actual production differs from the original prediction, as shown in the upper right circle on the chart, where both total quantity and pattern are different from those predicted, the variable budget curves will still permit comparison of actual with the adjusted standard costs.



ADJUSTED standard cost (right) replaces forecast standards.

This method is based upon past performance. Therefore, it does not present a goal of what might be achieved, but shows the probable performance at various rates of plant activity. In the plants to which the method has been applied, a satisfactory degree of precision has been obtained so that it has been useful for checking actual results and for predicting future cash and labor needs.

Where Cost Estimates Go Sour

What are the causes of overruns on construction projects? Who is responsible when earnings don't come up to anticipated levels? Here's a revealing management appraisal of the estimator's job.

CHAPLIN TYLER

This article is based on a recent off-the-cuff talk by Mr. Tyler to a group of chemical engineers interested in cost estimation. In its published form it takes the style of an interview, with questions posed by the Editor.

The practicing physician, when he loses a patient, often performs an autopsy to find out why. Wouldn't this be a good idea for the practicing engineer?

Yes, it would. A great deal has been learned from a study of actual costs vs. estimated costs for a number of projects.

Did your study include an analysis of operating costs?

Operating cost is only one factor affecting the financial performance of an industrial operation. The others are sales revenue and the average investment utilized in the accounting period under review. Investment in turn comprises two major categories—plants and properties, and working capital.

Inasmuch as these factors are more or less interdependent, the chemical engineer should have at least an elementary understanding of how each is estimated, and why, as often happens, the estimates "go sour." However, we are concerned here with inaccuracies of estimates rather than an exposition of how estimates are made. The analysis was clinical, rather than concerned with broad principles, and is therefore based on case studies.

Since most engineers think of cost estimates first in terms of investment or construction cost, suppose we tackle that subject first. What did your study show about construction estimates?

A review was made of nine major construction projects for which the total construction expenditures exceeded initial authorizations by 30 percent. Cases particularly unfavorable to the estimate were selected.

Although it is possible to ascribe this 30 percent overrun to numerous detailed causes, only a few were found to have major significance:

1. About two-fifths of the overrun was due to higher than anticipated labor rates and prices of materials and equipment. The projects were under construction in a period when there was a marked inflationary trend.
2. An additional two-fifths was due to underestimates caused by inadequate design information and to changes in design subsequent to project authorization.
3. About one-tenth was due to unexpected delays and consequent premiums paid for overtime and materials to expedite construction.
4. The remaining tenth was due to errors which largely might have been eliminated or reduced by greater skill or better judgment on the part of the estimator.

By regrouping the data supporting this analysis, it was found that about half of the overrun was due to causes (inflation and delays) beyond the control of management, whereas the other half was in areas within management control.

The effect of the inflationary trend in the postwar period can be appreciated by pointing out that the construction cost index has about doubled since the end of the war in 1945. Because of this rise in costs and an abnormal demand for chemicals of almost every type, there has been great pressure in many companies to rush projects to completion. Such conditions are not conducive to accurate estimating.

A common maxim of society states that a person cannot be held responsible for a given action unless he has the authority to control that action. The designer and estimator usually don't have any control over the spending of money on a construction job; that is the function of the job superintendent. Can you blame the estimate if the construction supervision is poor?

No. An overrun or an underrun on a job is not necessarily an indication that the estimate was sour. For example, there was an unusual case in which two plants of the same type were constructed by the same contractors at about the same time but were located 800 miles apart. On one there was an underrun of 4 percent and on the other an overrun of 10 percent. The only factor that can account for this is the difference in the capabilities and ingenuities of the two construction superintendents. Both were competent, but one was much more "cost-minded" than the other. He achieved significant economies through better scheduling and more efficient procedures.

We don't hear as much about working capital as we probably should. Do estimates ever go sour on that score?

Despite the importance of working capital as an investment component, errors of estimate concerning it did not figure significantly in the cases reviewed. This is due to the fact that in any long-established business, reliable working capital standards, based on experience, periodically are computed covering requirements for cash, receivables and inventories.

The likelihood of such standards being grossly inaccurate is slight.

Turning now to estimates of operating cost, what did your study reveal?

CHAPLIN TYLER, *author of the McGraw-Hill book, "Chemical Engineering Economics," is with Du Pont's development department in Wilmington. Early in his career he served on the editorial staff of CE (then Chem. & Met.).*

The study covered a large group of investments for which at least one year's performance could be measured against the project estimate. Some were large investments amounting to a million dollars or more each; some were about a tenth of this magnitude. Some were relatively simple situations such as extensions of existing plant; and others involved radically new technology, new products, or both. In screening these cases for analysis, the sole criterion was unsatisfactory performance.

What do you mean by "unsatisfactory performance?"

The term has no definition in general. But in this particular analysis an operation was considered unsatisfactory when in its first year it earned less than 50 percent of the amount predicted in the appropriation request.

Is it realistic to expect a project to meet predicted performance during its first year of operation? Don't you allow the production people time to get the bugs out of the process?

Actually, the project estimate is aimed at expected average performance over the life of the investment. However, comparison of the first year's results with the estimate was made in order to highlight the points of discrepancy. If analysis were delayed too long its value would be largely historical rather than practical.

How did these projects make out during their first year?

Twenty of the investments included in the analysis showed a loss. An additional 32, although profitable, showed unsatisfactory earnings, that is, less than 50 percent of the estimate. These 52 projects amounted to about two-fifths of the total.

What was wrong with these estimates?

That's hard to say exactly. In contrast with construction costs, it is much more difficult to analyze operations in order to show quantitatively the factors responsible for deficient performance. This is because a plant, when built, represents a fixed cost, whereas operating cost, sales price and sales volume are fluctuating factors.

Errors of estimate may be offsetting, or they may be cumulative in effect. Moreover, these factors must be estimated long in advance of initial performance. In such circumstances, the probability of obtaining a high degree of accuracy in any individual project is slight.

Analysis of the over-all deficiency in earnings of the 52 investments showed that:

1. About one-quarter of the deficiency was due to factors over which the estimator had no control, such as general business conditions and unusual delays caused by start-up difficulties.

2. About half was due to faulty market analysis; specifically, over-optimistic estimation of volume and misjudgment of the time required to develop markets.

3. The remaining quarter was due to persistent process or operational difficulties causing excessive costs, subnormal output and substandard quality.

So much for the question, "Where do cost estimates go sour?" Now for the $64 question: What can be done about it?

To say that better qualified estimators should be employed is a tempting answer, but it is only part of the answer. Skill and judgment are, of course, tremendously important. Nevertheless, the best estimators occasionally go wrong. In such instances, investigation of the circumstances surrounding the estimate is advisable before passing judgment.

As has been pointed out, inflation and associated factors were the causes of large errors of estimate in the seven postwar years. Although there was a leveling-off tendency in 1948 and 1949, the upward trend of costs was resumed in 1950. What will happen from here on nobody knows, but if any guessing is done management should assume the responsibility rather than the estimator.

Perhaps the best clue to the future is provided by the trend of wages, since in the final accounting 80 to 90 percent of costs consists of wages and salaries. Provision for advancing costs seems advisable as long as inflation remains unchecked.

The other major cause of error in construction cost estimates relates to the completeness and firmness of design. When estimates are based on preliminary design data the estimates are likely to be in error, more often on the low side.

Should preliminary estimates allow a greater contingency factor than firm estimates?

The use of a contingency factor of 10 percent or more, which is common practice, amounts to an expectation of that much overrun. The use of the factor does not reduce costs, but it sweetens the estimate and avoids or lessens unpleasant after-effects. It is simply a factor of ignorance.

An overrun is not necessarily an unmixed evil. Particularly in exploiting new fields, if a project is deferred until the design data are refined to a high degree, better accuracy of estimate can be expected. In the meantime, however, the competitive advantage of being earlier in production is lost. Then, too, in an inflationary period delays in starting construction and delays during construction usually turn out to be expensive, conceivably offsetting economies achieved through more advanced design. Here, again, such factors should be resolved by top management.

Your findings about faulty market analysis check with a recent statement made by a leading chemical executive.* This seems to be a serious factor.

That's right. In seeking better estimates of operating performance, the principal need would seem to be for more realistic market analysis. In gaging the market potential, the tendency is to be over-optimistic as to the price and volume obtainable—in brief, to underestimate the capabilities of one's competitors. For example, over-optimism amounting to 10 percent in price and 10 percent in volume readily might bring about a 50 percent reduction in the estimated operating profit. Happily for the investor, the strong growth and cost reduction potentials of chemical industry tend to bring about an improvement in many such initially disappointing situations.

Probably no aspect of estimation is as difficult as that of market analysis. It is true that careful, stepwise sales development and field surveys can provide accurate in-

* Charles H. Sommer, Jr., general manager, Merrimac Div., Monsanto Chemical Co., quoted in Chem. Eng., May 1952, p. 249. His statement: "In analyzing projects which did not measure up to estimates, the largest error was most often found in the sales manager's estimates of sales volume and selling price."

formation. However, some two to four years may elapse between authorization of plant construction and commercial-scale operation. In the meanwhile, market conditions will have changed, for better or for worse.

Many engineers find it difficult to estimate with suitable accuracy such factors of operating cost as labor and maintenance. How important are these?

With respect to production costs, the art of estimation has advanced so greatly in the past quarter century that good accuracy may be expected in all except the most recent technology. In fact, in the early stages of process development, the perils of overestimation may be as great as those of underestimation, if not greater. Assuming a process to be basically sound, research can be counted on progressively to reduce costs. However, a project abandoned because of high estimates may one day prove to be a lost opportunity.

In new fields, the estimator should consult with process engineers and production people as well as with research in an endeavor to foresee what performance reasonably might be expected on a scale-up. These ideas are then revised as development proceeds. From the established trend, good figures usually can be deduced.

The importance of good staff work can hardly be overemphasized. All too frequently there is insufficient collaboration between the research and development group and the engineering design group. The personal element also plays a part—design engineers tend to regard themselves as true professionals and to look upon research and development people as amateurs in engineering. On the other hand, the good research and development man is characteristically an optimist, regarding with impatience the matter-of-fact attitude of the designer and estimator who would like nothing better than a well frozen process. Then there is the market analyst, who appears superficial when judged by the rigorous standards prevailing in the physical sciences.

How can you achieve a harmonious and effective team effort with such diverse personal characteristics involved?

This is a function of top management, because the spirit that pervades an organization stems from whoever heads it. Here it is the design head on one hand and the research and development head on the other. In a certain instance a division head asked one of his project engineers if he had frequent contact with the men in the research division. He subtly hinted that the research men might have something to offer.

The idea is to get the men in the departments to collaborate. But collaboration must be encouraged at the top and be implemented by supervision all along the line.

In conclusion, it is clear that estimating is at best difficult. More often it is hazardous as well. The secret to better estimating is better teamwork—collaboration with design engineer· on the one hand and market analysts on the other hand- ıd the willingness by top management to assume the risks of long-range forecasting that properly are its own particular responsibility.

HOW TO ESTIMATE COSTS

Continued from page 171

that methane cost will be low compared to chlorine. The total raw materials, chlorine at $48 per ton, come to about $59 per ton of product. Taking raw materials conservatively at 70 percent of manufacturing cost (depreciation at the rate of 10 percent plant cost is only $7 per ton), we estimate the manufacturing cost at $84 per ton of total product ($391,000 per year).

Gross profit, annual basis, is then $374,000. Deducting selling and administrative overhead at 15 percent of sales (assuming greater than normal selling effort will be needed on this new product), the net profit after 70 percent taxes is $78,000, or 24 percent return on the $328,000 investment.

While these figures are merely preliminary, they indicate that further detailed study is warranted. Should the chlorine conversion realized be only 50 percent, the profit will drop to a much lower figure. The effect of varying sales prices for HCl is also indicated to be important in the profit picture, and the return on investment with HCl at no value is 7 percent.

EXAMPLE II

"Y" Chemical Co. is interested in further research on a plasticizer. Raw material costs add up to about $0.17 per lb. A minimum return after taxes of 15 percent on invested capital is desired. It is proposed to enter the market with capacity of about 5,000 tons per year.

Assuming raw materials equal 80 percent of manufacturing cost, the latter is estimated at $0.21 per lb. If a two-to-one ratio of sales price to manufacturing cost were taken, the sales price would be $0.42, high for plasticizers. Taking a cue from the price of diethyl phthalate, a preliminary estimate is made of $0.30 per lb.

Some knowledge of a possible process is available, which permits a plant cost estimate by analogy to diethyl phthalate. Taking the latter plant cost at $150 per annual ton, the projected plant is estimated at $200 per annual ton due to additional complexity. Thus, the plant cost is about $1,000,000. Using working capital at 20 percent of annual sales, total capital is estimated at $1,600,000. Checking depreciation, we find it to be only about $0.01 per lb. of product.

The gross profit per lb. then will be $0.09, the net after 10 percent overhead and 70 percent taxes $180,000, on an annual basis. This amounts to 11-12 percent return on total capital, less than required. It would seem that a selling price of at least $0.30 per pound is indicated.

REFERENCES

1. Aries, R. S., and Newton, R. D., "Chemical Engineering Cost Estimation," Chemonomics, 1950.
2. Carney, B. R., and Thompson, B. J., *Mech. Eng.*, 74, 467 (1952).
3. *Chem. Eng.*, Feb. 1952, p. 175 (staff report).
4. Chilton, C. H., *Chem. Eng.*, May 1951, p. 164.
5. Chilton, C. H., *Chem. Eng.*, June 1951, p. 108.
6. Dybdal, E. C., *Chem. Eng. Prog.*, 46, 57 (1950).
7. Faith, W. L., Keyes, D. B., and Clark, R. L., "Industrial Chemicals," Wiley, 1950.
8. *Ind. Eng. Chem.*, 44, 1193-1256 (1952).
9. Kiddoo, G., *Chem. Eng.*, Oct. 1951, p. 145.
10. Kinckiner, R. A., *Chem. Eng. Prog.*, 43, 183 (1947).
11. Scheumann, W. W., and Malakoff, H. L., *Oil Gas J.*, 49, 264 (1951).
12. Sommer, C. H., quoted in *Chem. Eng.*, May 1952, p. 249.
13. Soule, R. P., *Chem. Eng. News*, 28, 1102 (1950).
14. Wessel, H. E., *Chem. Eng.*, July 1952, p. 209.
15. Wilcoxon, B. H., *Chem. Eng.*, May 1947, p. 112.

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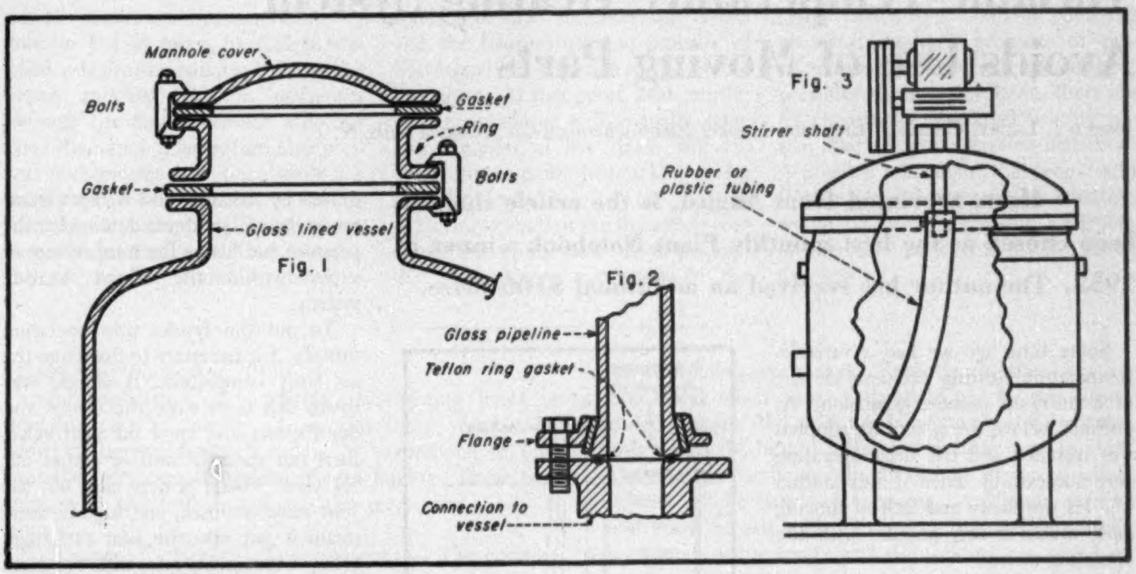


These Ideas Will Increase Life of Your Glass-Lined Vessels

P. P. Jones, *Chemical Engineer, Pinner, England.*

★ November (I) Contest Prize Winner*

Comparatively high cost of glass-lined process vessels, and their inherent low resistance to mechanical shock, put a premium on proper training of process operators, as well as careful maintenance. After a number of years experience with such vessels in a variety of chemical manufacturing processes, I have found that the following suggestions can extend their useful life for many years.

1. *Damage to Lining Around Manhole*—A spot that is vulnerable to mechanical damage is the rim of the manhole opening. Periodical removal and replacement of the cover invariably results in chipping of the glass. This trouble can be practically eliminated if a separate glass-coated ring is obtained (see Fig. 1) and fitted on the rim of the manhole opening so that this ring suffers any chipping. It can be replaced by a spare ring while the other is returned to the manufacturer for re-lining. Sometimes this ring need only be coated with a sprayed-on plastic.

2. *Hydrogen Penetration*—Apart from direct mechanical damage due to falling bolts or tools, glass linings sometimes develop cracks which are followed by flaking off of the glass for no apparent reason. This is usually due to poor care of the outside of the glass-lined vessel in allowing bare iron to become wetted with an acid solution. The effect of this can be demonstrated very easily with a standard test piece such as a thermometer well, which is a tube closed at one end and coated with glass enamel on the outside. If we pour a solution of hydrochloric acid into the tube and allow it to stand for a day or so, the glass lining will gradually crack and peel off as a result of the pressure produced by hydrogen gas generated in the iron. Although this test greatly accelerates the conditions that may be obtained outside a chemical plant vessel, sufficiently acid conditions could easily result from an overflow of acid liquors, or condensation of steam in an acid atmosphere, or even from acid-contaminated cooling water in jackets.

(Continued on page 203)

* Starting with this issue, each number of *Chemical Engineering* will come to you a month earlier. To effect the change-over of publication date it has been necessary to pick two Plant Notebook contest winners in November.

★November Contest Prize Winner (II)

"How to Rig Distilling Column Bubble Caps for Easier Replacement."

A prize of $50 in cash will be awarded to Roland P. Loewen, production superintendent, Monsanto Chemical Co., Anniston, Ala. His article will appear in the February Plant Notebook section.

$50 PRIZE FOR A GOOD IDEA—Until further notice the Editors of *Chemical Engineering*, will award $50 cash each month to the author of the best short article received that month and accepted for publication in the Plant Notebook. Each month's winner will be announced the second following month and published the third following month.

$100 ANNUAL PRIZE—At the end of each year the monthly winners will be rejudged to determine the year's best Plant Notebook article, which will then be awarded an additional $100 prize.

HOW TO ENTER CONTEST—Any reader of *Chemical Engineering*, other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 500 words, but illustrated if possible. Articles which are acceptable but are not winners will be published at regular space rates ($10 minimum).

Articles may deal with plant or production "kinks," or novel means of presenting useful data, which will interest chemical engineers. Address Plant Notebook Editor, *Chemical Engineering*, 330 West 42nd St., New York 36, N. Y.

WINNER OF 1952 ANNUAL PLANT NOTEBOOK AWARD

Variable-Temperature Heating System Avoids Use of Moving Parts

JOSEPH I. LACEY, *Chemical Engineer, Hooker Electrochemical Co., Niagara Falls, N. Y.*

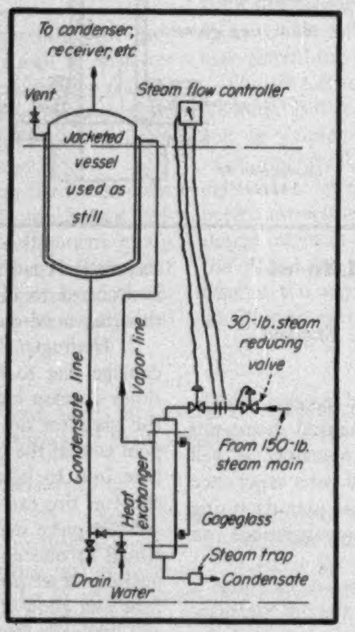
Here, reprinted from August, is the article that has been chosen as the best monthly Plant Notebook winner of 1952. The author has received an additional $100 prize.

Some time ago we had a variable-temperature heating problem as part of a hurry-up process expansion. As outlined below, the system we adopted was installed and has been operating very successfully since it was started up. Its simplicity and lack of moving parts makes it very popular with the operating men.

The Problem—It was necessary to develop and install a heating system for a jacketed vessel. This vessel was to be used to vacuum distill a volatile solvent from a liquid product that is somewhat heat sensitive. Available information indicated that a pot temperature of 80-100 deg. C. might be required. It was clear that, the lower the jacket temperature, the less would be the decomposition, and the slower the distillation rate. Therefore, it was necessary to devise some easy method of varying the jacket temperature so that the optimum operating conditions could be found.

The Solution—The accompanying sketch shows the type of system adopted. It is a closed-circuit steam heating system to which heat is provided indirectly by live steam supplied to the tubes of a vertical shell-and-tube heat exchanger. The heat exchanger acts as a boiler, producing steam from water contained in the closed system, at any desired pressure from sub-atmospheric to a pressure not much below that of the supply steam.

The exchanger is installed vertically below the jacketed still, with the upper shell connection piped to the top of the vessel jacket, and the jacket bottom outlet piped to a drain, to a water supply line, and to the lower shell connection of the exchanger. High pressure steam from a 150-psig. line is



supplied through a reducing valve at 30 psig., passing through an orifice and flow control valve to the upper end of the tube side of the exchanger. The lower end of the tubes discharges condensate through a steam trap. The shell side of the exchanger is provided with a gage glass, while a vent valve is installed on top of the vessel jacket.

The object of this set-up is to provide a steam-heated water boiler which can supply heating vapor at any saturation temperature between a low, corresponding to a fairly high vacuum, and a high which is only a few degrees below the temperature of the supply steam. The only control needed is the steam flow controller which regulates the rate at which heat is supplied to the boiler. The relation between rate of heat supply, and rate of heat withdrawal by radiation and by heat transfer to the still contents determines the pressure and hence the temperature of vapor within the closed heating system.

To put the system into operation initially it is necessary to discharge the air fairly completely. A simple way to do this is to close the return and drain valves and open the vent valve, then run water in until it comes out the vent. Water is then shut off, the vent valve is closed, and high-pressure steam is put into the heat exchanger tubes at maximum rate, with the drain valve open. Water boils in the shell side of the exchanger, builds up pressure, and forces liquid water out through the drain. This is continued until the gage glass shows the heat exchanger shell side to be about two-thirds full. Steam is shut off and the valves set in normal operating position. This operation exhausts most of the air and if the system is reasonably vacuum-tight, need not be repeated often. An occasional check of jacket temperature vs. pressure of the vapor will indicate when another purge is necessary.

During normal operation the water level of the closed system should be about two-thirds on the gage glass when the system is cold. When live steam is put into the heat exchanger through the flow controller, water will vaporize on the shell side, building up in pressure and corresponding saturation temperature of the vapor. Vapor will flow upward to the vessel jacket and there condense, transferring heat to the vessel contents.

Obviously, transfer of heat to the liquid in the vessel will depend both on the vessel conditions and on the temperature of vapor in the jacket. But for any given set of vessel conditions, such as height, character and agitation of contents, the rate of heat transfer will depend on the vapor temperature alone. But for any given steam supply to the heat exchanger,

only so many Btu. per min. will be available for transfer from the vapor to the vessel contents. Therefore, the jacket pressure and temperature will adjust themselves automatically to transfer just as much heat as is supplied—neglecting radiation. More live steam supplied to the exchanger through the flow controller will thus raise the vapor temperature and pressure and transfer more heat, while less supply steam will have the reverse effect. In any event, the jacket temperature will be the lowest that can give the rate of heat transfer needed to produce the distillation rate that is desired.

At the end of distillation if the live steam is left on, there will be very little transfer of heat to the empty vessel and the temperature and pressure of the vapor will approach those of the live steam. At that point, heat transfer in the exchanger will virtually cease and the flow of live steam will fall below the set point, just making up for radiation losses.

During operation the live steam condenses and condensate leaves through the trap. Vapor condenses in the vessel jacket and its condensate returns to replenish the water supply in the shell side of the exchanger. Thus, except for air in-leakage into the vapor system when it is cold, or operating at sub-atmospheric pressure, or possible vapor losses when operating at pressures above atmospheric, there are no changes in the closed heating system that require operating attention. A possible refinement that would still further decrease the need for attention would be to tie a pressure controller on the vessel jacket into the live steam flow control.

(*Continued from page* 201)

Careful application of a reliable acid-resisting paint is desirable on the outside of all glass-lined vessels. In addition, lagging materials should be maintained to prevent the formation of pockets of acid liquors. These two steps will practically eliminate this particular kind of trouble.

3. *Damage From Hard Gasket Materials*—The connection of glass pipelines to glass-lined steel vessels always requires a suitable gasket to cushion the joint and resist attack from the chemicals handled. In a large number of cases hard, compressed asbestos is suitable, but the tightening of the flange bolts required to give a good seal very often results in fracture of the glass. Although Teflon sleeves over a resilient base are satisfactory, there is an alternative in which the resilient base is avoided. Furthermore, less of the expensive Teflon is needed. This consists of the hollow Teflon tubing used for wire covering. It can be molded in the form of rings of the right size to fit into the grooves on standard borosilicate glass pipelines, as in Fig. 2. The hollow gasket so formed results in a strong resilient joint.

4. *Damage to Stirrer*—The stirrers normally used in glass-lined mixing vessels are often vulnerable to damage owing to the sharp angles of the paddles or propellers. Although damage to a stirrer is not so serious as damage to the main body of a vessel lining, the vessel is put out of service while the stirrer is dismantled and sent away to the manufacturer for re-coating. When temporary repairs such as patching with cement, or plugging with tantalum or Teflon are not possible, the vessel can still be kept in operation while the stirrer is being re-coated by a simple trick. The idea is to fix a suitable length of stout rubber or flexible plastic tubing over the stub of the drive shaft of the normal stirrer, as shown in Fig. 3. For speeds up to 100 rpm. satisfactory mixing can be obtained, and a certain degree of variation of mixing characteristics is possible by varying the length of tubing used.

Dry Ice Aids Weld Repairs, Stops HF Leakage

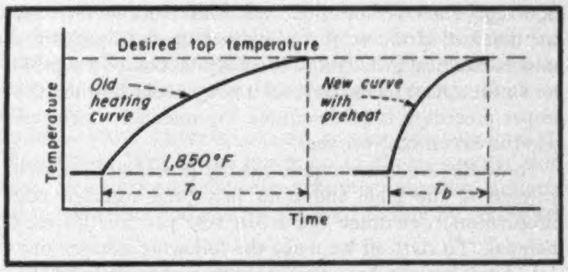
PAUL C. ZIEMKE, *Safety Engineer, Oak Ridge, Tenn.*

The welder looks to the chemical engineer to suggest safe techniques when confronted with unusual conditions in his equipment-repair work. Recently an ether blowcase sprang a leak when under hydrostatic test by the inspection department. When drained the fumes still indicated a high degree of hazard when the welding was to start.

The engineer in charge brought in 3 lb. of dry ice which he placed in the hand-hole opening. A 15-min. waiting period filled the case with CO_2 gas to the complete exclusion of any volatile fumes and the welding proceeded on schedule without mishap.

On another occasion a heavy drum containing "Transil Oil" which circulates through the winding space of a heavy-duty electromagnet showed weep conditions at a welded seam. In this case the oil level was lowered below the defect by pumping to a second tank having some excess space. Then the dry ice was injected to form the replacement gas that permitted torch welding with efficiency and safety.

When the leaking valve atop a cylinder of hydrogen fluoride could not be shut off due to metal galling or corrosion, a bag of dry ice was fastened around the valve for the trip out to the disposal area. There the leak could dissipate in safety.



Preheat Increases Heating Rate In a Processing Furnace

THOMAS H. ELMER, *Chemical Engineer, Corning Glass Works, Corning, N. Y.*

Some time ago a job called for a rapid firing schedule from 1,850 deg. F. to a desired higher temperature. Even at maximum heat input, the heating schedule of the furnace to be used was too slow. It was necessary to find some means for improving the heating characteristics without going to a lot of extra trouble and expense.

This was accomplished as follows:

1. We first heated the furnace to the desired top temperature without the charge.
2. Then we cooled the furnace rapidly to 1,850 deg. F. by lowering the furnace hearth.
3. Then we introduced the charge and heated it to the desired temperature at the faster rate.

While the furnace was initially being heated from 1,850 deg. F. to the final temperature, heat was being stored in the refractory walls of the furnace. Then, even though the inside temperature of the furnace was dropped rapidly to 1,850 deg. F., the heat stored in the walls did not decrease as rapidly and thus greatly exceeded the value which existed when the furnace idled at 1,850 deg. F. In effect, this provided an extra heat supply so that the rise in temperature upon reheating was considerably faster than when the furnace had not been subjected to the preheat cycle of Step 1.

The curves above show the approximate order of the "before-and-after" heating rates we obtained, T_a being the time before the use of preheating, and T_b the time when preheating was used.

How to Evaluate Economy of Construction Materials

Paul E. Krystow, *Corrosion Group, Esso Engineering Dept., Standard Oil Development Co., Elizabeth, N. J.*

Design engineers often do not realize the tremendous importance of corrosion data, simply because they do not understand how to use such information in their design work. For example, an engineer may be asked to determine the most economical piping material for handling 60 percent H_2SO_4 at 200 deg. F. By consulting the literature he may find corrosion data for such a case, listed here in the second column of the accompanying table which gives corrosion rate in inches penetration per year (IPY).

Offhand, many design engineers faced with such a tabulation would be inclined to select the material with the lowest corrosion rate, and would probably rate them in increasing order of corrosion rate, with Duriron first and cast iron last. However, this would not necessarily give the most economical installation. If contamination of the product by the construction material is not a problem, then the proper procedure is to determine the material which will give the lowest cost per year.

To do this we first compute the life expectancy for each material in the table and from that (and installed cost information) determine the actual cost per year for each material. To start off we make the following assumptions:

1. Since we are here dealing with piping material, we will assume that 100 ft. of pipe with four fittings and two valves will be used.
2. We will assume that the life of the piping terminates when half of the original thickness of the wall has been corroded away.

With these assumptions we proceed by four steps. To assure a clearer understanding it is suggested that the reader follow through each of the steps for one of the construction materials listed in the table.

1. From the pipe size and schedule number, determine the wall thickness of each material to be used.

Economic Comparison of Construction Materials

Material	Inches per Year *	Wall Thickness, 2-In. Pipe, Inches	Life Expectancy, Years	Total Cost, $	Cost per Year, $
Chemical lead	0.008	3/16	11.7	613	53
Duriron	0.006	Sch. 40 (0.154)	12.8	991	78
Mild steel	0.270	Sch. 80 (0.218)	0.4	277	693
Monel metal	0.046	Sch. 40 (0.154)	1.7	1,184	697
Cast iron	0.890	Sch. 80 (0.218)	0.1	126	1,260

* Data from Tech. Bull. T-3, Oct. 1948, p. 32, International Nickel Co.

2. Compute the life expectancy in years by dividing half the wall thickness in inches by the expected IPY.
3. If possible, secure actual data on the labor and material cost for each construction material under consideration. If such data are not readily available, use the data of R. A. Dickson on pipe cost estimation (*Chem. Eng.*, pp. 123-135, Jan. 1950). Dickson's report gives labor and materials costs for most kinds of piping materials, but is based on July 1949 costs. Therefore, to allow for present-day inflationary values, it is necessary to "factor" his data up to the present by the use of a suitable index, such as the Marshall and Stevens indexes published monthly and revised quarterly in *Chemical Engineering*. The data used here were taken from Dickson's figures.
4. From the total cost and life expectancy, calculate the yearly cost of each piping string by dividing the cost by the life expectancy.

Following through these four steps for each construction material produces the table given here. The most economical material, i.e., the one with the lowest cost per year, turns out to be chemical lead, which rated second in corrosion rate. Note that the order of increasing cost is quite different from the order of increasing corrosion rate.

The same method can be applied to any corrosive environment, enabling the design engineer to select the most economical material for any particular service.

$$\frac{14.7\,\#}{\text{in.}^2}\ \Big|\ \frac{144\ \text{in.}^2}{\text{ft.}^2}\ \Big|\ \frac{\text{ft.}^3\ \text{of}\ H_2O}{62.4\ \text{lb.}} = 33.91\ \text{ft.}\left(\frac{\#}{\text{lb.}}\right)\ \text{of}\ H_2O$$

Where # = force-pounds and lb. = mass-pounds.

One Way to Prevent Confusion Over Force- and Mass-Pounds

Albert L. Wilson, *Chemical Engineer, Columbia-Southern Chemical Corp., Corpus Christi, Tex.*

Here is a simple little scheme that will largely eliminate the confusion that arises from the use of force-pounds and mass-pounds in engineering calculations. The idea is merely to use the symbol # for force-pounds, and lb. for mass-pounds. Although the # symbol commonly is taken to mean "number," many engineers already use it for "pounds." The symbol is found on all standard typewriters.

In this way there is no chance for the two units to be confused and mistakenly cancelled out in checking the dimensions of engineering calculations. As an example, take the conversion above where the water-head equivalent is determined for a pressure of 1 atm.

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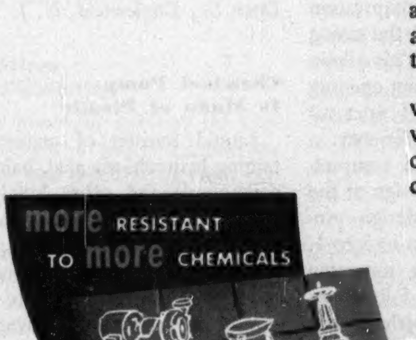

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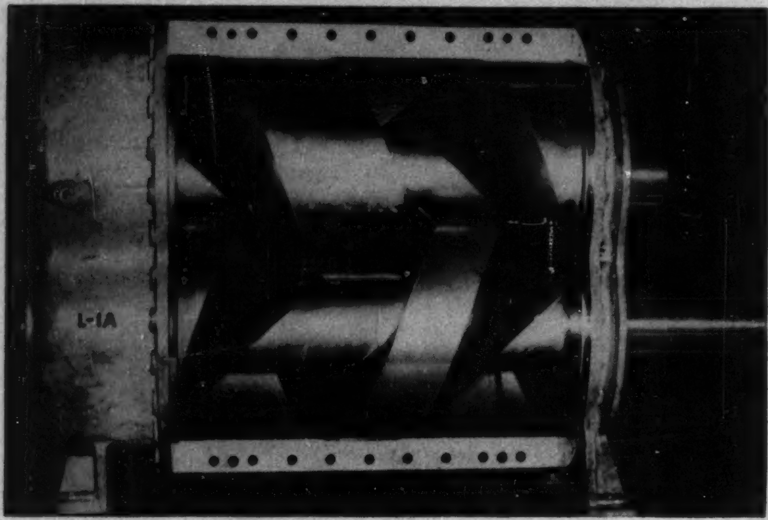
Process Equipment News Edited by Calvin S. Cronan

NEW FLUIDS HANDLING EQUIPMENT



Meshing Screws Compress Air

Two parallel, meshing screw rotors give compressor a high volumetric efficiency. Machine plugs a gap between conventional rotary positive and centrifugal compressors.

Almost one hundred years have elapsed since the Roots brothers conceived the rotary blower bearing their name. Now the successors of those early designers have come up with a compressor based on that long proven blower yet entirely new in principle.

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4. Low noise level—smooth operation.
5. Light weight.

Instead of conventional rotors, the Spiraxial compressor employs two intermeshing screw-rotors which rotate in opposite directions. These screws are operated by gears synchronized to prevent contact, allowing close but very definite clearances between them. The screw rotors are formed along a spiral surface which is accurately generated to maintain proper clearances.

There is also a close radial clearance between the rotating parts and the casing. However, the distance between inlet headplate and rotors is sufficient to allow unequal expansion of rotors and casing without seizing.

Flow of air or gas being compressed is axial with most of the compression taking place at the back of the casing near the discharge port. This allows use of an extremely large inlet opening preventing strangulation of inlet air and increasing volumetric efficiency.

The amount of internal compression is controlled by the design of the discharge port. Present design provides compression ratios up to 3 to 1. For a given port design operating pressure can be varied 3 to 5 lb. either side of design pressure without loss in efficiency.

Capacity of the compressor pictured above is 1,120 cfm. operating at 20 psig. discharge pressure with a bhp. requirement of 118. Other sizes are available.—*Roots-Connersville Blower, Connersville, Ind.*

Drum Faucet Has Spring-Loaded Washer

A new lock-lever drum faucet has a cupped spring washer to assure positive shutoff without leaking. This washer exerts constant and even pressure to keep the faucet plug seated.

Constructed of close-grained grey iron, the faucet is available with or without threaded hose connection. A special aluminum lacquer provides normal protection for non-corrosive application.—*Morse Manufacturing Co., 100 Dickerson St., Syracuse, N. Y.*

Angle-Style Toggle Valve Is Leak-Resistant

A new angle-style, lever-type, quick acting toggle valve is suitable for controlling high vacuums and pressures up to 500 psi. It is said this valve will not leak under pressure either through the stem or seat. These valves are ideal for instrument panel installation and can be furnished with threaded bonnets and mounting nut for this application.

Internal construction is brass and synthetic rubber. Valve seat material is normally synthetic rubber, but can be altered to meet specific conditions of operation. For identification purposes, the lever arm can be threaded for the mounting of plastic knobs in various colors.—*Hoke, Inc., 139 S. Dean St., Englewood, N. J.*

Chemical Pump Is Made of Plastic

Liquid transfer of materials containing hydrochloric acid, halogenated compounds and other highly corrosive materials can be satisfactorily handled even at elevated temperatures with the Worthington Haveg pump. All liquid contacting parts of this unit are constructed of Haveg plastic, which is well known for its resistance to chemical attack. The pump shaft is sealed with a non-metallic mechanical seal. Bolting is of monel metal. Pump frame is cast iron protected by acid-resisting paint. — *Worthington Corp., Harrison, N. J.*

Equipment Cost Indexes

(Marshall & Stevens Indexes, 1926 = 100)

Industry	Sept. 1951	June 1952	Sept. 1952
Average of all	179.1	180.3	180.5
Process Industries			
Cement mfg.	171.5	172.6	172.7
Chemical	179.5	181.0	181.1
Clay products	166.5	167.6	167.7
Glass mfg.	169.6	170.7	171.1
Paint mfg.	172.8	174.3	174.4
Paper mfg.	173.1	174.6	174.7
Petroleum ind.	175.9	177.4	177.8
Rubber ind.	178.3	179.8	180.2
Process ind. avg....	176.9	178.4	178.6
Related Industries			
Elec. power equip...	181.1	182.6	183.0
Mining, milling	180.2	181.7	182.1
Refrigerating	198.6	200.5	200.9
Steam power	168.7	170.3	170.7

Compiled quarterly for March, June, September and December of each year by Marshall and Stevens, evaluation engineers, Chicago and Los Angeles. Indexes are prepared for 47 different industries, from which the eight process and four related industries listed here are selected. Published each month with the latest available revision. For a description of the method of obtaining the index numbers see R. W. Stevens, **Chemical Engineering**, Nov. 1947, pp. 124-6. For a listing of annual averages since 1913 see **Chemical Engineering**, Feb. 1952, p. 191.

IN BRIEF—A capsulated listing of this month's newsworthy equipment.

Stainless Steel Tank Has Floating Cover

An inverted air-seal cover that actually floats on the tank contents eliminates danger of contamination, evaporation and oxidation in a new line of stainless steel tanks. Made of transparent plastic, the cover fits closely against the sides of the round tank. Thus, tank contents may be visually checked.

With the cover in place and air completely excluded, mixing operations can be carried out without aeration, it is said.

Available in sizes from 10 to 600 gal., the tanks are Heliarc welded and passivated.—*Reco Sales Co., 70 East 45th St., New York, N. Y.*

Drum Mixer Offers Flexibility

A new mixer for agitating the contents of cans or drums is designed for maximum ease in changing from one container to another. The drive assembly, mounted on a sturdy vertical post, swings easily around the post for location over one of several containers. Agitator height is adjusted through a hand crank and gear track. Easy removal of the turbine agitator is accomplished simply by twisting it in the socket and lowering it. This makes it relatively easy to use different agitators on different products.—*Industrial Process Engineers, 8 Lister Ave., Newark 5, N. J.*

Solenoid Valve Gives Fast Cycling

Cycling between open and closed positions at rates up to 600 times per minute is easily attained with the Model 1034 three-way solenoid-controlled and pilot-operated valve. This unit is designed to control any light fluid medium such as air, water and light oil over pressure ranges from 20 to 500 psi. Minimum travel of moving parts assures fastest possible valve action.

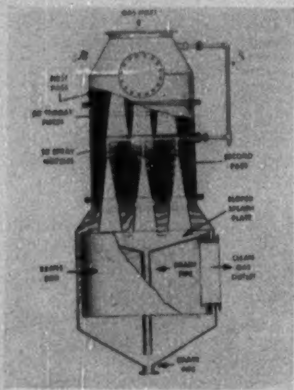
Valve bodies of cast bronze are supplied with three threaded connections corresponding with the nominal port sizes of ¼, ⅜, ½ and ¾ in. The free port area in each case is equal to or greater than the internal cross-sectional area of equivalent standard pipe. Internal parts are brass and stainless steel. Synthetic rubber valve rings provide tight sealing.—*Barksdale Valves, 1566 East Slauson Ave., Los Angeles 11, Calif.*

Plug Valve Design Minimizes Wear

Time-proved principles of plug valve design have been combined with the use of O-ring seals in a new recirculating valve for dividing flow streams. The externally adjustable spring-seating control features multiple ball pressure contact against a hardened wear ring. This is said to assure absence of leaking; handle loads and internal wear are reduced to a minimum.

The 2-in. size now being produced is rated 125 psi. Recent tests indicate

minimum pressure drop and full-pipe orifice flow characteristics during operation. Valve is available in cast aluminum, steel, or Navy bronze. Bronze and steel valves are cadmium plated throughout. Flange connections are available for either male or female thread adaption.—*Ardee Mfg. Co., 840 North Seward St., Los Angeles 38, Calif.*



Packaged Gas Scrubber Gives Good Contact

High scrubbing efficiency and low maintenance are claimed for a new packaged gas scrubber. The equipment will handle gas containing wettable solids and condensable gases as well as gases and solids where either the gas or solids will chemically react with a selected spray liquid. In the case of gases containing non-wettable solids or dust a suitable wetting agent can be introduced into the spray liquid.

Component parts of this unit are the scrubber box, spray nozzles, and throat pieces. The scrubber box, enclosing all components, is divided into compartments or banks. Units can be constructed with as many banks as necessary although two are sufficient for most operations. The number of nozzles and throat pieces per bank are determined by the volume and characteristics of the gas and the scrubbing efficiency required.

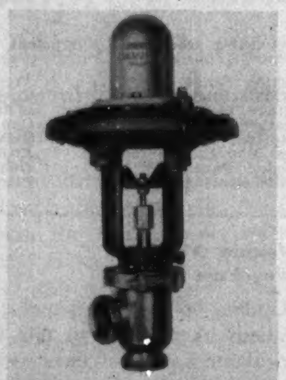
In operation the gas enters the scrubber through an inlet pipe. The suction action of the spray from the nozzles draws the gas into the throat pieces of the first bank of the scrubber, where the liquid and gas are thoroughly mixed. The mixed liquid and gas discharges into the next bank where it is entrained and forced through the throat pieces. The washed, cooled gas coming out of the last bank is discharged through the outlet pipe.—*Schutte & Koerting Co., Dept. J-I, Cornwells Heights, Bucks County, Pa.*

Multiple Pump Handles Several Fluids

As many as six different fluids can be delivered at fixed regulated flow rates by the Brosites six-in-one pump.

The pumping tubes, fabricated of rubber or plastic, are mounted in a vertical position, three on each side of a constant speed gear head motor. Suitable mechanical linkage from the motor reciprocates compressor plates in and out against the sides of the flexible tubes.

Adjustment of pumping rate is secured by a thumb screw which varies the tube position with respect to the compressor plate. This varies tube compression from partial to full, altering the pumping rate accordingly.—*Brosites Machine Co., Inc., 50 Church St., New York 7, N. Y.*

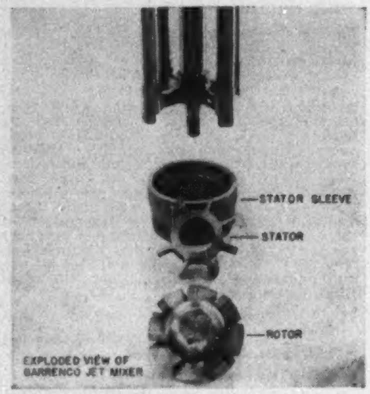


Sanitary Motor Valve Controls High Flow

The Saniflo two-way motor valve has been designed specifically for sanitary operation in the food processing industry. Among the several features offered by this valve are body design for high flow capacity, friction free power application by the diaphragm motor, and provision for quick, easy, disassembly to permit cleaning.

All parts exposed to product are Type 18-8 corrosion-resistant stainless steel. The one-piece stem and plunger eliminates threads and crevices which would harbor bacteria formation. To clean, the operator simply snaps the quick disconnect clamp to remove the valve body, and loosens the hand nut to remove the plunger stem. There are no gaskets or stuffing boxes to complicate cleaning; neoprene O-rings are used between body and bonnet, bonnet and valve stem.

Valve connections are 3A (IAMD thread) male, ground seat type. Standard line sizes 1 through 3 in. are available.—*The Foxboro Co., Foxboro, Mass.*



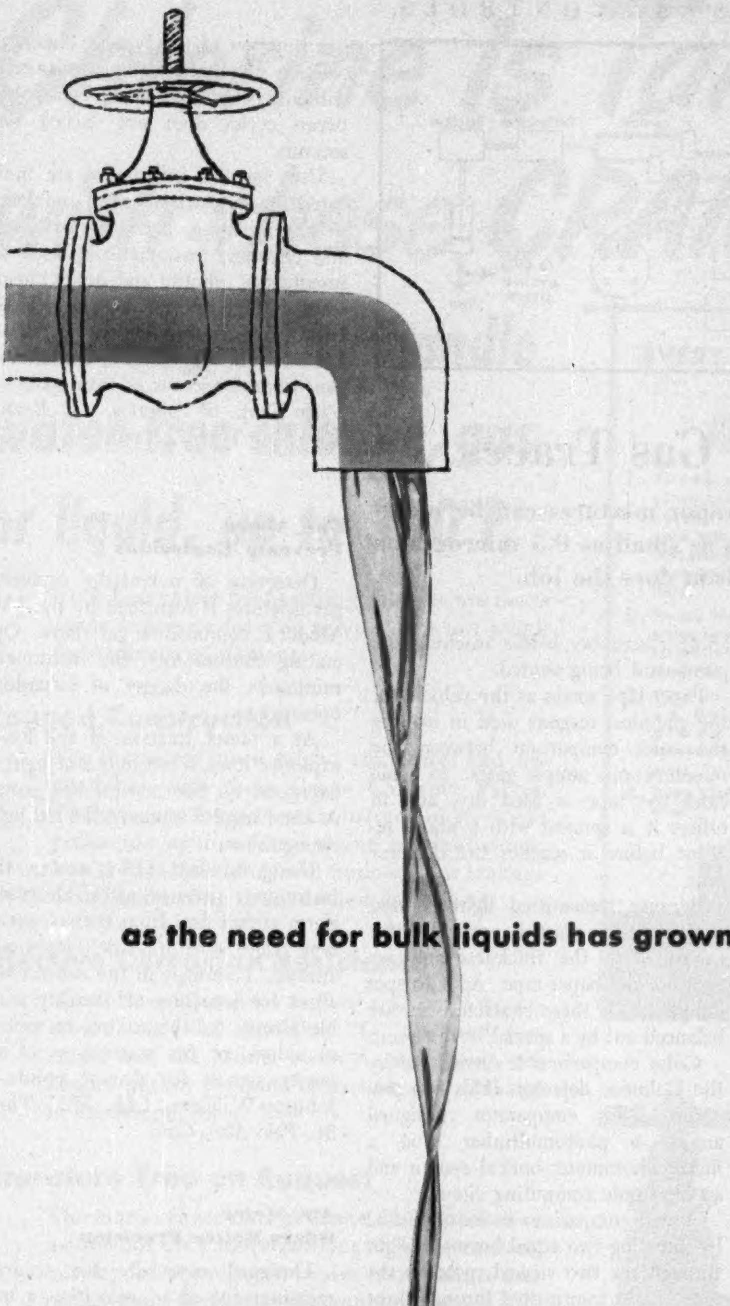
Mixer-Homogenizer Eliminates Aeration

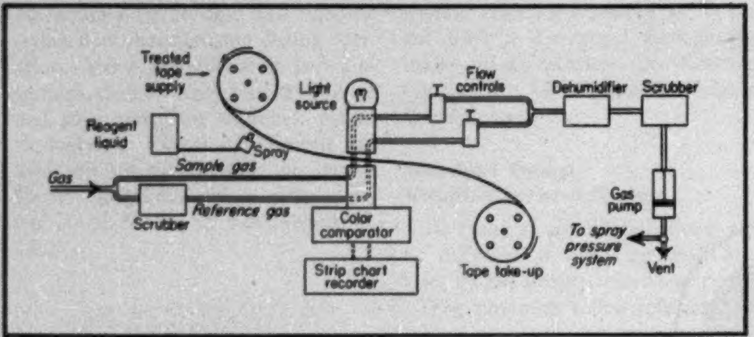
The Jet mixer is a high-speed combination mixer-homogenizer said to outperform any mixer operating at or near its peripheral velocity. Rotor peripheral speeds of 50 to 100 ft. per sec. provide wet mixing without aeration or surface boil over a viscosity range up to 30,000 centipoises.

As seen in the exploded view above, the mixer consists of three basic elements. A rotor mounted on the drive spindle is housed inside a sleeve below a stator. Material being mixed enters the bottom opening of the sleeve and discharges through the top. Modifications in design, such as the placing of screens at the entrance and discharge openings, variation in rotor pitch, narowed discharge openings in the sleeve sidewall, and discharge deflectors all affect the degree of mixing or homogenization obtained.

Rotor diameters vary from 1.5 in. in the ½-hp. size to 6.5 in. in the 10-hp. size. Units are also available up to 20 hp.

Optimum mixing results are obtained when the mixing vessel I.D. is not greater than eight times the turbine O.D. Also, hemispherical or conical bottoms are more desirable than flat or pitched bottoms.—*Barrington Engineering Corp., 110 West 40th St., New York 36, N. Y.*


GATX



Analyzer Detects Gas Traces

Constituents of gas or vapor mixtures can be measured automatically in quantities as small as 0.5 micrograms per liter. Precise color comparison does the job.

Extreme sensitivity marks the Microsensor, an instrument for detecting and measuring micro quantities of single components in streams or atmospheres of gas or vapor. It is said the device measures changes in gas compositions on the order of 1 percent in concentrations as low as one part per million.

The Microsensor is essentially a refined color comparator. Gases being detected or measured must be capable of reacting with chemical reagents to produce color change. Highly sensitive color reactions used in microanalysis techniques are performed continually and automatically. The amount of color change is a clear measure of quantity for the particular material being detected.

As indicated above the instrument consists of three principal parts; a gas intake system, a reel of chemically treated paper tape and a precision color comparator.

A continuous sample of the gas stream or atmosphere to be analyzed is split into two channels as it enters the instrument. The first, or reference channel, contains an activated charcoal scrubber to filter the gas before it passes through the tape at the detector unit. Gas from the other or sample channel is passed directly through the tape.

The two channeled flows of gas are kept exactly equal by means of flow control devices. At a point beyond the tape the channels rejoin and the gas is drawn through a dehumidifier and another scrubber before reaching the pump and being vented.

Paper tape serves as the vehicle for the chemical reagent used in making the color comparison between the reference and sample gases. In some cases the tape is used dry, and in others it is sprayed with a liquid reagent before it reaches the detector unit.

Because transmitted light is used compensation must be provided for variations in the thickness and porosity of the paper tape. Spot to spot differences in these characteristics are balanced out by a special servo circuit.

Color comparison is carried out by the Colorede detector. This is a precision light comparator designed around a photomultiplier tube, a flicker photometer optical system and an electronic computing circuit.

Actual comparison is accomplished by directing two equal beams of light through the two viewed spots on the tape. Light transmitted through these two spots is alternately directed on the photomultiplier tube by the flicker system.

Output from the photomultiplier is on alternating signal with an amplitude proportional to the intensity difference of the two beams. This signal is amplified, synchronously rectified to a d.c. voltage, and used to control the recording instrument and the gas alarm circuit.

Operation of the Microsensor is carried out automatically in continuously repeating cycles. Cycle length is a function of the type of chemical reaction involved for the gaseous constituent being measured. Time between cycles does not exceed ten seconds.

Uses for this instrument are indicated for industrial control problems in electroplating, petroleum refining, and chemical manufacturing such as insecticides, plastics and heavy chemicals. Other applications are to be found in protecting human health and life where danger exists of contamination from dangerous or toxic gases.—*Vitro Corp. of America, 233 Broadway, New York 7, N. Y.*

Gas Alarm Prevents Explosions

Detection of potentially explosive gas mixtures is furnished by the J-W Model E combustible gas alarm. Operating continuously, the instrument minimizes the danger of hazardous operations.

At a preset fraction of the lower explosive level, a red indicator light is energized on the control box panel. As the hazard is removed the red light extinguishes.

Using standard 115-v. power, the instrument features an all-electronic alarm circuit free from meters, meter type relays, and other delicate mechanisms. Terminals in the control box allow for actuation of auxiliary audible alarms, for the control of motors or valves, or for connection of repeater signals for distant points.—*Johnson-Williams, Ltd., 2723 Third St., Palo Alto, Calif.*

Air Meter Offers Better Precision

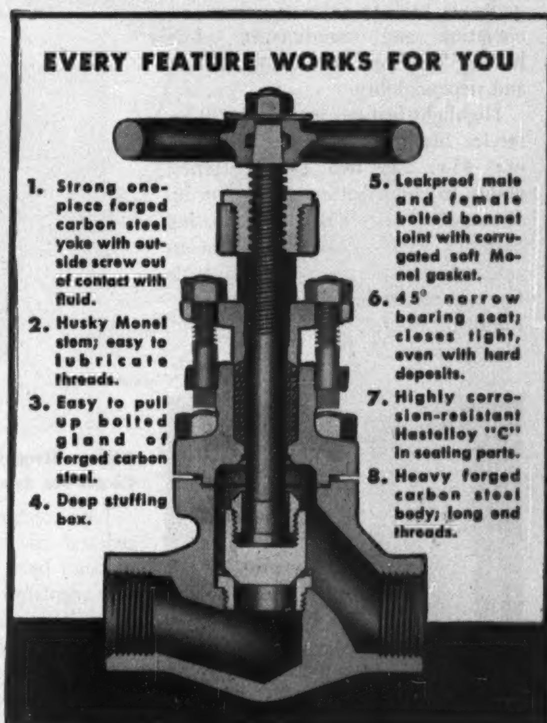
Designed especially for accurate measurement of air velocities, a new air meter responds in less than one second. Meter accuracy is within 1½ percent and is unaffected by temperature variations, radiation, or normal fluctuations in atmospheric pressure. Used in conjunction with a relay system, the meter can serve as an effective system of process control.

Consisting of a measuring element and an indicating unit, the instrument operates on normal 110-v., 60-cycle current. A dual range scale covers 0 to 400 fpm. and 400 to 6,000 fpm. Provision can be made for using one

Chlorine is Tamer with these CRANE Valves

. . . Designed to handle water-free chlorine, gas or liquid, up to 300°F.

Your best valves for handling chlorine are those made expressly for this service. It's too tough for ordinary equipment.



Rugged Construction

You'll operate more safely, efficiently, and dependably with these Crane Chlorine Valves. Their rugged forged steel construction gives you protection against internal and external shock. You'll have freedom from bonnet joint leakage with their strong Crane bolted design.

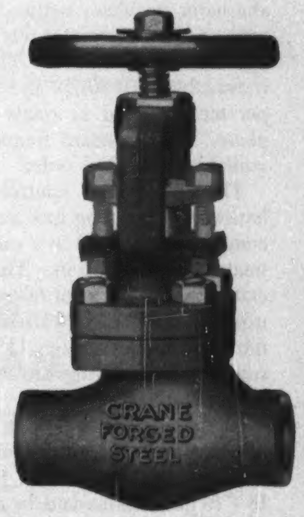
Effective Corrosion Resistance

You'll be equipped for highest resistance to corrosion with the Hastelloy "C" disc and seat rings, and the Monel stem. A corrugated soft Monel gasket prevents corrosion and leakage at the bonnet joint.

Literature Free on Request

The many refinements of Crane Chlorine Valves assure not only more efficient chlorine control, but important savings on valve maintenance and replacement costs. Get the complete facts in Circular AD-1608. Write or ask your Crane Representative for a copy.

No. 1645 Angle Sizes ½ to 2 in.



No. 1644 Globe Sizes ½ to 2 in.

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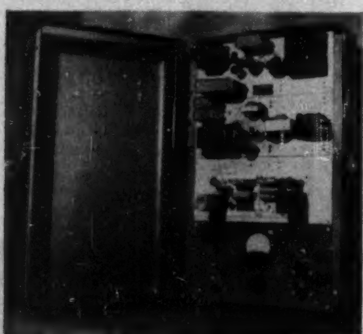
indicating unit with several measuring probes located at various points.—*Hastings Instrument Co., Inc., Super Highway at Pine Ave., Hampton 10, Va.*

Portable pH Meter Needs Less Maintenance

The new Photovolt portable pH meter is said to offer simplicity of operation and maintenance while holding to a high standard of accuracy and dependability.

Highlight features include 2,000 hr. service life for the power source of one 45-v. and two 1½-v. batteries; ability to check battery voltage on instrument voltmeter without removing batteries from case; instantaneous readings without warmup; adaptable for any electrodes on the market.—*Photovolt Corp., 95 Madison Ave., New York 16, N. Y.*

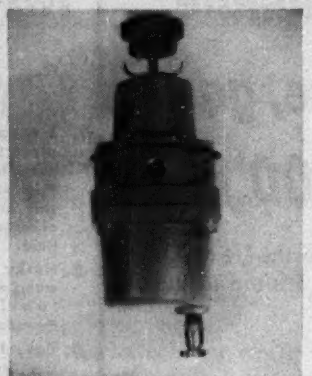


Frequency Control Holds Alternator

A recently announced constant frequency control is designed to hold alternator frequency within 0.001 percent on motor generator sets supplying up to 10 kw. of power. The control is available with 50, 60 and 400 cycles per sec. standard in single or three-phase. Non-standard frequencies are available on special order.

The electronic control consists basically of a tuning fork and a phase comparator enclosed in a case approximately 6 x 24 x 36 in. The unit operates on 115 v., 50 or 60-cycle power using approximately 150 watts. The motor generator requires 115/230 d.c. supply. Other ratings are available on special order.

In operation, the output of the alternator of the motor generator set is held in synchronism with the tuning fork frequency standard by comparing the alternator phase with that of the tuning fork. As the alternator phase begins to lag, the current in the control winding on the main shunt field of the d.c. motor is increased. The control field bucks the main field and increasing control field current tends to cause an increase in motor speed. Thus the alternator is held in synchronism. — *General Electric Co., Schenectady 5, N. Y.*



Filter Regulator Controls Instrument Air

Line pressures up to 150 psi. can be reduced to 0-35 psi. instrument air pressure by a new combination pressure regulator and filter. This device is similar in many respects to an earlier model since both operate on the pneumatic balance principle.

In the new unit the diaphragm chamber is isolated from the output passage, then joined with a small feedback passage. This type of construction helps to eliminate undesirable buzzing by preventing full output air volume from impinging on the diaphragm. The design also permits guidance of the pilot stem to ensure positive seating against the supply and exhaust ports, minimizing air consumption.

The filter element is a self-contained cylinder made of helically-wound ribbons of phenolic-resin-impregnated cellulose. This element is said to remove particles of oil, water and solids as small as 40 microns.—*Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne & Windrum Aves., Philadelphia 44, Pa.*

Temperature Transmitter For Chemical Plants

The Type T2T Autronic temperature transmitter has been designed for use in chemical and food processing plants, refineries, and petrochemical plants. The unit consists of a resistance thermometer element and thermometer adapter unit.

The thermometer element is made of pure platinum wire wound on a ceramic core and sealed in an Inconel tube. Resistance changes in the thermometer element are converted by the adapter unit to a proportional signal which varies from 0.0 to 0.5 v.

Connection between the thermometer element and adapter unit is by a three-wire system that compensates for variations in lead-wire resistance with ambient temperature change. A special adjustment in the adapter unit provides compensation for minor variations in thermometer element resistance. Removable range cards give a variety of temperature spans.—*The Swartwout Co., 18511 Euclid Ave., Cleveland 12, Ohio.*

Smoke Indicator Monitors Stack

Avoidance of air pollution and maintenance of good combustion efficiency are greatly aided by use of the Fire-eye Series FE photoelectric smoke indicator. This unit continually indicates smoke density passing through the stack and signals when the density exceeds a pre-set value.

The smoke indicator consists of three basic units: a light source, a photoelectric scanner, and a control and indicator combined in a single housing. The light source and scanner are mounted on opposite sides of the stack or breeching. The indicator is placed at any convenient location. The alarm can be set to operate at any predetermined value of smoke density from 10 to 100 percent of light cutoff. —*Combustion Control Corp., 720 Beacon St., Boston 15, Mass.*

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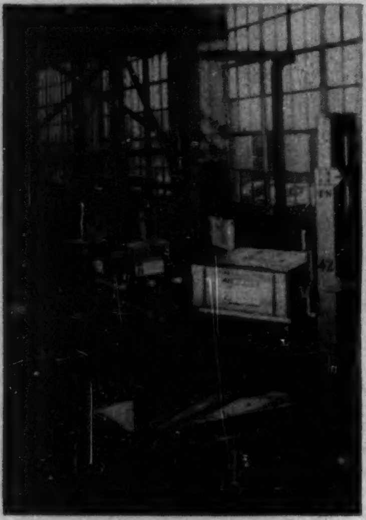
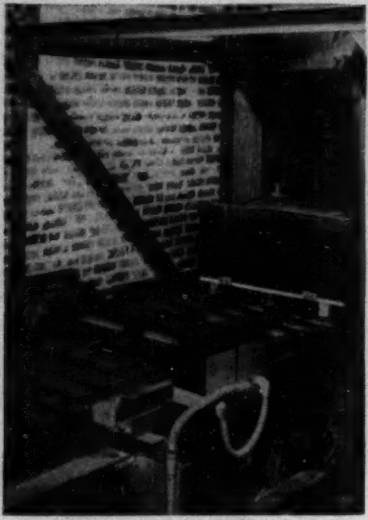
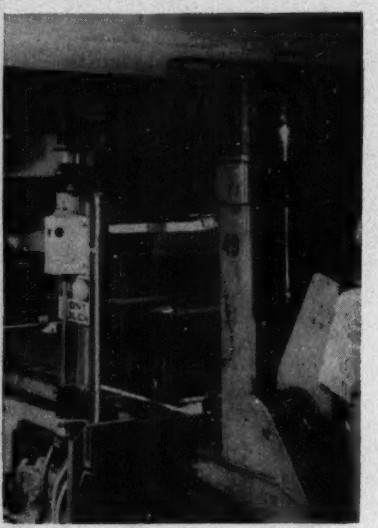


FEEDER receives incoming bundles.



LOWERATOR feeds take-away belt.



DISCHARGE point controls operation.

Conveyor Smooths-Out Unloading Operation

Heavy bundles are transferred in a steady flow from over-the-road trucks to basement storage. Aisle congestion is relieved, labor reduced and unloading time cut.

An automatic lowerator-conveyor system has been installed at the Continental Can Co., Baltimore, Md., for moving heavy tinplate bundles from the unloading area to basement storage. Time to unload over-the-road trucks has been cut 66 percent. One fork truck now does the work of two formerly used for unloading. An elevator has been freed for other use and aisle congestion around the elevator has been eliminated.

Adaptations of this system are believed to be applicable wherever fairly large quantities of materials must be transported between floors with relative frequency.

Previous unloading practice at Continental required two fork trucks to carry incoming tinplate a distance of 140 ft. to an elevator. Elevator capacity was only two bundles which was insufficient to keep up with the fork trucks. Thus tinplate had to be stored temporarily near the elevator entrance. Distance plus congestion slowed operations to the point where it took half an hour to unload an over-the-road truck.

The lowerator was installed near the unloading platform to eliminate the long fork truck hauls. Now only one fork truck is required for unloading. In addition unloading time has been reduced from 30 to 10 min.

The system comprises three units; the lowerator, a feeder conveyor and a take-off conveyor.

Bundles of tinplate are removed from over-the-road trucks by a fork truck and placed on the first floor feeder conveyor. This conveyor carries bundles to the lowerator which in turn lowers them to the basement. There the take-off conveyor takes them to a discharge point where they are picked up by a fork truck and taken to storage.

Control of the operation rests on the use of photoelectric eyes. A conveyor-high beam at the discharge end of the basement conveyor starts and stops the system, moving up bundles to replace those taken to storage. As a bundle is removed from the conveyor, the electric-eye beam makes contact and starts the entire system in motion.

When that happens the following sequence of events takes place:

1. The basement conveyor brings the next bundle to the discharge point and stops when the bundle breaks the electric-eye beam.
2. While this is taking place, the lowerator discharges its present bundle to the basement conveyor and returns to the first floor for another bundle.
3. A bundle is fed to the lowerator by the first floor conveyor. Bundle automatically stops in the center of the lowerator tray.
4. The lowerator returns to the basement.
5. The fork truck operator on the first floor places another bundle on the first floor conveyor.
6. The first floor conveyor moves the next bundle to the shaft and an electric eye stops it at this point. A limit switch is also installed should the electric eye fail.

Each movement of the bundles is controlled by an electric eye and limit switch. Thus each conveying unit will move only when the next unit in line is ready to receive its load.

The basement fork truck takes two bundles to storage at one time. One bundle is removed and set on top of the next bundle as the conveyor moves it into place. Then both bundles are lifted together and transported to storage.

One fork truck on the first floor can keep two basement fork trucks busy even though the latter carry two bundles at a time. This is entirely due to the long hauls made in the storage

area whereas the ground-floor truck operates within a few truck lengths of the end of the feed conveyor.—*Gifford-Wood Co., Hudson, N. Y.*

Collapsible Shelter Protects Loading Dock

That strip of unloading dock between building entrance and freight car door can now be sheltered against the ravages of weather. Men and materials can move across the dock space with full protection. Thus, personnel efficiency is increased and valuable material is protected against damage.

Protection is afforded by a new collapsible shelter of canvas mounted on a steel framework. When not in use, the shelter can be collapsed flush against the building.—*Atlas Products Co., 1300 West Washington Blvd., Chicago 7, Ill.*

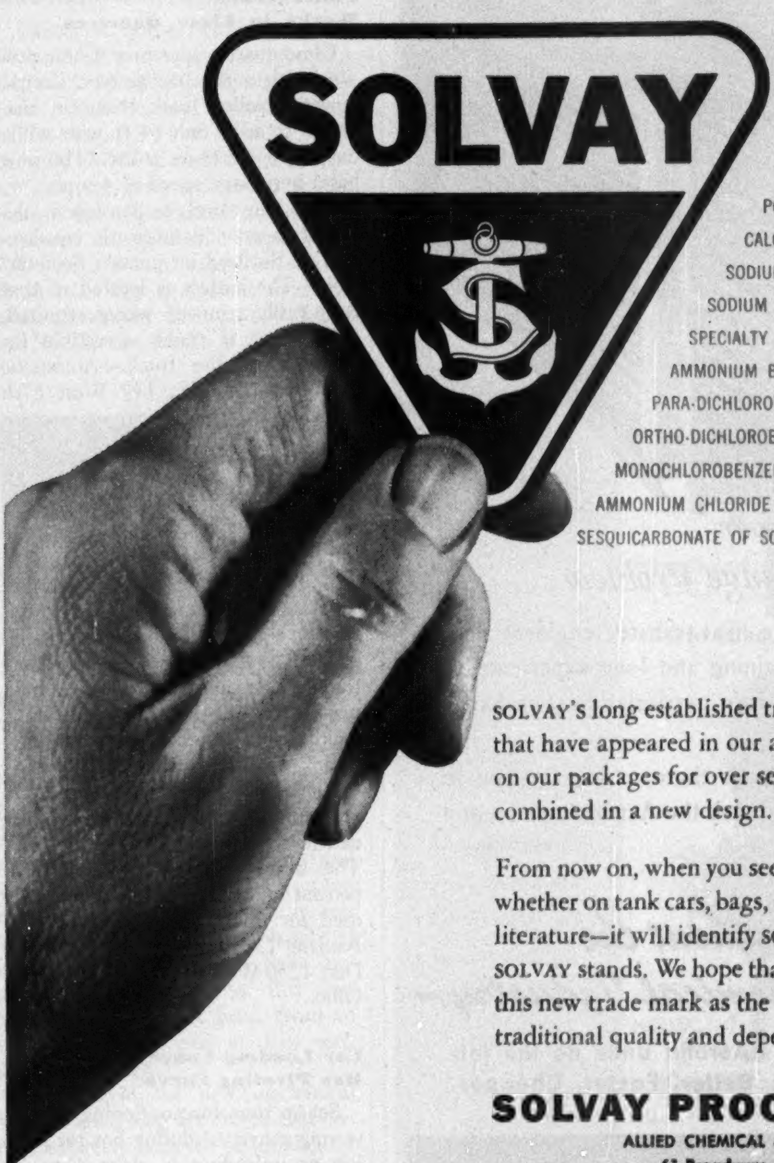
Standup Fork Trucks Turn in Close Quarters

A recently announced electric, standup fork truck is said to operate within its own length. Belonging in the 2,000-lb. capacity class, this truck is said to provide driver comfort, easy off and on access, convenience of controls, and excellent visibility.

The Stoway model has a 60-in. turning radius and 360-deg. steering. Travel speed is 6.5 mph. empty and 6 mph. loaded with four speeds forward or reverse. A three-point suspension system assures traction on uneven surfaces.

Other features include both live and dead man braking. In addition, torque braking is used. All vital parts are readily accessible for inspection and service.—*Clark Equipment Co., Industrial Truck Div., Battle Creek, Mich.*

Meet Solvay's New Trade Mark



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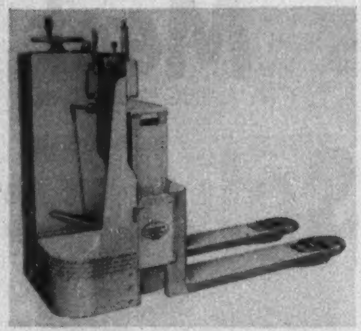


Pallet Truck Works in Close Quarters

Close quarter operation is now possible with a new riding type electric powered pallet truck that can maneuver in aisles only 6½ ft. wide while carrying a 40x48-in. pallet. The unit has a horizontal speed of 4 mph.

The four-wheel suspension is designed to provide automatic equalization of the load on uneven floor surfaces. The battery is located so that it is easily removed where required, although it is readily accessible for charging in the truck.—*Automatic Transportation Co., 149 West 87th St., Chicago 20, Ill.*

Fork Truck Model Travels at Fast Clip

A new 2,500-lb. capacity electric fork truck travels at speeds up to 7 mph. and can make a U-turn in an 8.5-ft. aisle. Among the design features of this FS-25 model are a worm-gear-driven power axle, a gyroscopic trailing axle construction for ease in negotiating uneven surfaces, dynamic braking, and a special heavy-duty motor.

The dynamic braking feature prevents motor burnouts caused by sudden reversals in the truck's direction. The heavy-duty motor contains 30 percent more copper than normally used for trucks of this size.—*Baker-Raulang Co., Baker Industrial Truck Div., 1230 West 80th St., Cleveland 2, Ohio.*

Car Loading Conveyor Has Pivoting Curve

Set-up time for positioning and reversing conveyors during box car loading or unloading is claimed to be eliminated in a new conveyor design. The section of the conveyor containing the 90-deg. curve pivots like a crank handle in a vertical direction. The

wheels or rollers on the half section extend above the channel on both sides, enabling it to function when flipped in either direction. This permits the direction of flow to be changed 180 deg. simply by changing the position from left to right as needed. The straight conveyor section extending from the end of the curve or half section into the box car is telescopic to satisfy loading needs.—*Wilkie Co., 5520 Arch St., Philadelphia 39, Pa.*

Tiering Truck Has Adjustable Base Forks

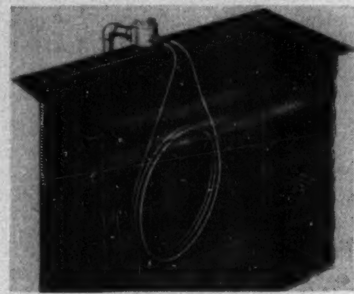
Pallets of various widths can now be handled by one straddle type tiering truck fitted with adjustable base forks. This feature permits lifting pallets ranging in size from 32 to 48 in. wide. Made of rugged welded-steel sections, the forks are hinged to the main frame and adjusted manually by a screw arrangement. Trucks with 2,000 to 3,000 lb. capacities can be fitted with this equipment modification.—*Raymond Corp., 5699 Madison St., Greene, N. Y.*

Heavy Fork Truck Works Inside and Outside

Two newly designed heavy-duty fork trucks are said to be suitable for both outside and inside work. These 3,000 and 4,000-lb. capacity models are gasoline-engine powered and mounted on pneumatic tires. Outstanding features offered are shorter over-all length, longer wheel base, and better weight distribution than usually found in a truck of this size. Special attention has been given to operator comfort, ease of daily servicing, and safety.

Included in the new mechanical features are a long life clutch that can be completely removed or installed in less than an hour. Also, the large heavy-duty disk-type brakes are said to eliminate many service and maintenance problems.—*Hyster Co., 2902 N. E. Clackamas St., Portland 8, Ore.*

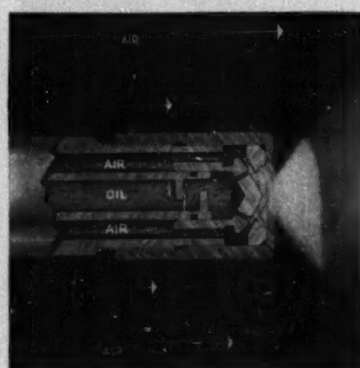
NEW HEATING & COOLING EQUIPMENT



Immersion Heater Has Lead Sheath

A new immersion-type electric heating unit for electroplating baths has a thick lead sheath which resists corrosive acid action of copper, chrome and nickel solutions. Dilution of the electroplating bath is eliminated. Higher temperatures can be obtained, resulting in faster, smoother plating. The heater is completely portable; is simply hung over the side of the tank.

Rated at 5 kw. on 230 v., the heater has dimensions of 3 x 16 x 27 in. Terminals are protected by a moisture-tight cast iron housing. Separate thermostatic control is possible for fully automatic temperature regulation.—*Edwin L. Wiegand Co., 7500 Thomas Blvd., Pittsburgh 8, Pa.*



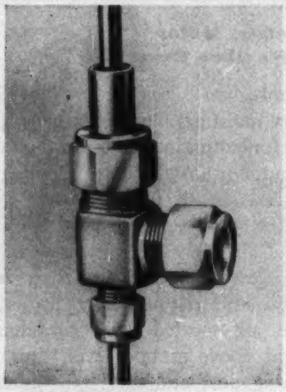
Oil Burner Atomizes Oil Completely

The Voriflow oil burner is said to give complete oil atomization over a wide range of fuel viscosities. In addition, the design permits throttling from 100 percent load down to 30 percent capacity. Only about 1 percent of the total full load combustion air is required for atomization in the burner tip.

Fuel oil flows through the central oil tube and is picked up at multiple

injection points by individual air streams from the concentric outer air tube. Dams near the end of the oil tube prevent dripping of the oil after shutdown.

This new burner design is said to eliminate coking on the burner and refractory throat which results when heavy fuels are incompletely atomized. Drooling and carbonizing which increase cleaning and maintenance costs are completely eliminated with the Voriflow burner, it is said.—*Orr & Sembower, Inc., Morgantown Road, Reading, Pa.*



Heat Exchanger Tee Is Precision Made

A new heat exchanger tee has been designed for steam jacketing or temperature control of process lines. It is said to be useful in all cases where exchange of heat between coolants and process fluid is required.

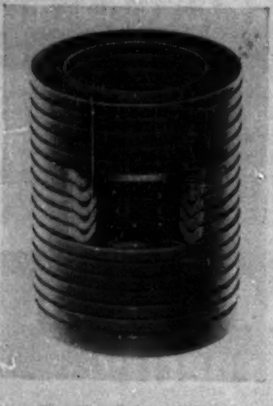
The fitting is available in sizes up to 1 in. O.D. for the jacketing tube and is furnished in either brass, aluminum, steel, stainless steel or Monel.—*Crawford Fitting Co., 884 E. 140th St., Cleveland 10, Ohio.*

Sparger Nozzles Resist Chemical Action

Sparger nozzles used in tank heating liquids with live steam are now being constructed of Haveg 60. This material is a molded product highly resistant to acids, salts and solvents.

One of these nozzles in a 100-gal. tank will consume 183 lb. per hr. of steam at 40 psi., raising the tank liquid 40 deg. F. in 11 minutes. At the same time liquid circulation rate through the nozzle is 20 gpm.

Nozzles may be installed in standard tapped holes for ½-in. pipe thread or they may be cemented in place.—*Schutte & Koerting Co., Cornwells Heights, Bucks Co., Pa.*

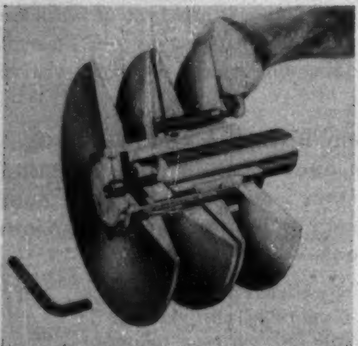


Hydraulic Packing Rings Give Efficient Seal

The Periflex Set No. 88 consists of V cross-section packing rings together with male and female end adapters. These rings are precision molded from a special Neoprene compound. It is said there are no joints or taper overlaps which can split or fail under heat or friction.

The convex curve of the internal lip surface allows each ring to function independent of the adjacent ring and provides a lubricant reservoir. Increased pressure only tends to increase the efficiency of sealing.

The seals are designed primarily for rod seals. Lip interference automatically preloads the packing in the stuffing box, eliminating the necessity of all but initial gland adjustment where split rings are specified and used.—*Periflex, Inc., Hazel Park, Mich.*



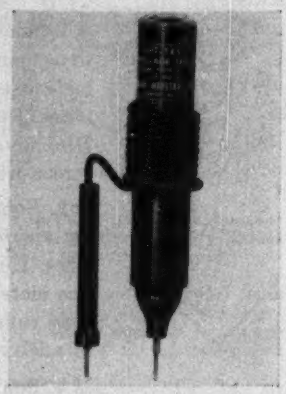
Variable Pitch Sheave Cuts Speed Change Time

A new variable speed drive is said to cut down-time on speed changes and increase production. Compact design is featured with the sheaves occupying minimum space on the shaft.

Components of this variable speed drive are (1) a variable pitch motor sheave, (2) a set of wide range belts (3) a companion driven sheave, (4) a slide motor base. Sheave bushings incorporate the Taper-Lock principle, which contributes to the rapidity and ease of speed changes. Pitch diameter is changed easily and positively by means of a one point adjustment.

The "R" section belts have deep side walls which help ensure longer life. Transverse ribs provide great lateral rigidity. The belts are oil-proof, heat resistant, and static conducting.

The slide motor base permits changes in center distances to preserve proper belt tension as the variable pitch sheave is adjusted for different speeds.—*Dodge Mfg. Corp., Mishawaka, Ind.*

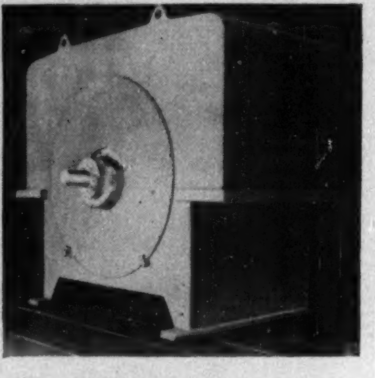


Voltage Tester Offers Ease of Use

The Hi-Test voltage tester has one prod mounted in the end of the tester. The second prod terminates the end of a wire connected to the body of the tester. This arrangement makes for ease of operation in securing voltage readings.

The opposite end of the tester from the prod houses a drum type scale covered and protected by a magnifying lens. A safety ring around the end of the prod handle prevents fingers from slipping off and touching the prod.

The Hi-Test tester indicates a.c. or d.c. voltages from 115 to 600 v. Overall length is 8½ in.; test lead with 4-in. plastic handle 48 in.; weight with carrying case 10 oz.—*Holub Industries, Inc., 413 Dekalb Ave., Sycamore, Ill.*



Electric Motor Is Weather Protected

Protection against wind-driven heavy moisture is provided by this design for motors located on semi-outdoor or outdoor installations. Cooling air moves vertically upward through side intakes at a velocity less than 600 fpm. This is sufficiently low to prevent heavy rain particles from being drawn into the motor. The air intakes are located at a considerable height above ground level, thus preventing dust and dirt from entering the machine during dry weather. Discharge air passes out the bottom of the machine at either end.

Rain gutters are provided on the sides at the air intakes, draining through pipes to the ground. The top of the yoke is slanted slightly to keep water from accumulating in puddles on top.—*Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.*

Motorized Sweeper Cuts Cleanup Cost

Sweeping of plant and warehouse floor space is done at greatly reduced cost and time, using a new, improved, motorized industrial sweeper. Combined in the unit are a powerful rotary brush sweeper and heavy duty vacuum

Try

TRI-CLOVER

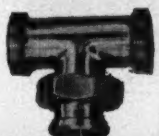
. . . for the __best__ solution to your

CORROSION-RESISTANT PIPING PROBLEMS

"ZEPHYRWELD" WELDING FITTINGS—SS Type 304, 347, 316, fabricated in O.D. TUBE Size, ½ in. thru 24 in. Full line of ells, tees, crosses, adapters, etc.

CONICAL END FITTING—SS Type 316, and other SS analyses. Complete lines of ells, tees, crosses, adapters, etc., sizes from 1 in. thru 4 in. O.D.

RECESSED END FITTINGS—SS Type 304, 347, 316, sizes from ½ in. thru 24 in., for fast simple soldering, brazing or socket welding. Full line of ells, tees, crosses, etc.

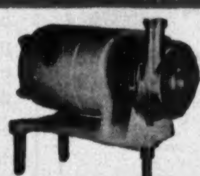


STAINLESS STEEL SANITARY TYPE FITTINGS—in a complete line, 1 in. thru 4 in. O.D. Approved as meeting 3A Standards throughout, these precision fittings are the "standard [illegible]"

SPECIAL FABRICATION—Fabricated fittings and assemblies to your specifications. FULL corrosion resistance assured through scientific precision welding and controlled [illegible]

SCHEDULE 5-S and 10-S WELDING FITTINGS—"Zephyrweld" SS Type 304, 347, 316, full range of sizes, ½ in. thru 24 in. PIPE SIZE, for use with SS light gauge pipe.

[illegible] SANITARY TRAP—Fabricated from [illegible] sheet type 316 Austenitic stainless steel in 2", 3" and 4" O.D. sizes with Acme sanitary threads. [illegible]



SANITARY and INDUSTRIAL PUMPS—"headquarters" for a complete line of sanitary and industrial corrosion-resistant pumps for liquids and semi-solids.

TRI-CLOVER offers 32 years of specialized experience in solving sanitary and industrial corrosion-resistant piping problems. Skilled craftsmen and engineers in four completely equipped plants have made the name *Tri-Clover* on stainless steel and alloy fittings, valves, pumps, and specialties signify unexcelled performance.

Your selection of the *right* fitting, valve, pump, tubing or pipe for the *right* job is made easier by Tri-Clover's complete production and engineering facilities. Benefit from this fact. For here is one dependable source . . . one responsibility for your sanitary and industrial piping problems.

Our experienced engineering service is at your disposal to help solve your specific corrosion-resistant piping problems.

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Kenosha, Wisconsin

TRIALLOY AND STAINLESS STEEL SANITARY FITTINGS, VALVES, PUMPS, TUBING, SPECIALTIES

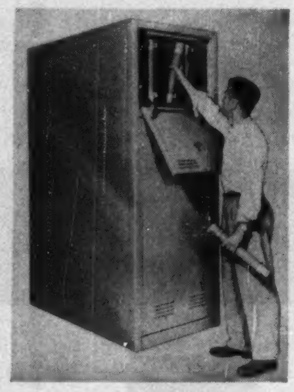
FABRICATED STAINLESS STEEL INDUSTRIAL FITTINGS AND INDUSTRIAL PUMPS

THE Complete LINE

1-153

cleaner. The machine is said to be highly efficient on dust, dirt, steel shavings, scrap paper, cardboard, grass, leaves, small metal parts, and milling debris.

Sweeping is done by eight sturdy hardwood palmyra-filled brushes welded into a single circular unit 17-in. in diameter and 36-in. long. A 1½-hp. air-cooled engine furnishes the power for operating the sweeper up to a speed of 4 mph.—*Multi-Clean Products, Inc., 2277 Ford Parkway, St. Paul 1, Minn.*



High Voltage Fuses Now Safer to Handle

A new gang-operated disconnect method de-energizes fuses on high-voltage motor controls making them safe and convenient for handling.

Fuses are gang-mounted on a movable panel inside the SA-FUSE high-voltage fuse compartment. On the back of the panel are mounted disconnecting blades. When the fuse compartment door is opened the fuse panel is automatically pulled to the front of the compartment. This disconnects the fuse panel from the line, putting the fuses within easy reach. Then the operator can safely and easily remove and replace the fuses without using a hooked stick.

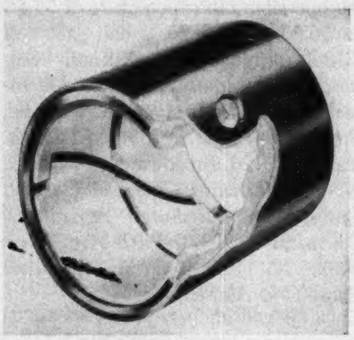
Complete mechanical and electrical interlocks prevent fuses being disconnected when switch is closed and prevents closing motor switch with door open.—*Electric Machinery Mfg Co., 1335 Tyler St., N.E., Minneapolis, Minn.*

Aluminum Panel Holds Eight Big Breakers

The recently developed DTP cast aluminum dust-tight and weather-resistant panel board accommodates up

to 8 three-pole 100-amp. 600-v. circuit breakers. The panel board is suitable for use in Class II hazardous locations and is said to be the first one of its type capable of handling circuit breakers larger than 50 amp. and 250-v.

The panel board consists of a rectangular cast aluminum enclosure with gasketed cover and dust-tight weather-resistant external operating mechanisms for the circuit breakers. These mechanisms are constructed so that they engage the circuit breaker handles after the cover is installed. The enclosu e walls are sufficiently thick to permit drilling and tapping for branch conduits anywhere in the ends or sides.—*Crouse-Hinds Co., 1347 Wolf St., Syracuse 1, N. Y.*



Sleeve Bearing Has Nylon Liner

Nylon and steel have been combined in a new sleeve bearing design said to overcome previous limitations encountered in nylon bearings. Although widely recognized for its excellent bearing characteristics, nylon has not previously been satisfactory due to expansion from temperature changes and moisture absorption.

Thin wall Nylined bearings are said to overcome these difficulties by providing a steel sleeve having a Nylon liner with a spiral compensation gap. This gap permits dimensional changes in circumference due to expansion and contraction. Where lubrication is required it again serves to distribute lubricant in an axial direction.

Among the claimed advantages for this bearing are decreased friction, damping of mechanical vibration, satisfactory dry operation, and a minimum number of abrasion failures. The bearings are corrosion resistant and can be operated submerged in most liquids.—*Thomson Industries, Manhasset, N. Y.* —End

Product News Edited by Frances Arne

NO WEEDS choke out cotton in rows, left, treated with CIPC.

Bright Prospects for Herbicide

The country's weedy cotton fields may make a vast market for new herbicide, CIPC. Good test performances brought three new producers into the picture in six months.

CIPC may well be the hottest new herbicide to come along since 2,4-D. What 2,4-D did to annihilate broadleafed weeds, CIPC—chemically, isopropyl n-(3-chlorophenyl) carbamate—promises to do to weedy grasses.

The Dept. of Agriculture and a number of companies are still in the midst of extensive field tests. Reports so far have been universally encouraging and point to a large market in the cotton fields. A second probable market is weed control in field legumes such as soybeans and alfalfa. Another is in protecting vegetables like spinach and lettuce.

One authority dares to guess that its consumpton will go to 15 million pounds by 1955. It was 20,000 in the 1951-52 season. If CIPC really hits the way 2,4-D has and lives up to the high hopes of those who know most about it, this guess is downright conservative. At any rate, the number of manufacturers recently galvanized into action certainly is a kind of declaration of faith.

- Monsanto started commercial production several months ago at their new plant at Santa Clara, Calif.
- U. S. Industrial Chemicals put a Baltimore plant on stream in November, perhaps the largest in the nation. As raw material, the company uses phosgene in which the company is basic.
- Pittsburgh Agricultural Chemical Co. went into commercial production the first of this year. It had been operating a pilot plant at its Neville Island plant for some time.
- American Chemical Paint Co., while it does not manufacture CIPC at present, has done a great deal of experimental work with it and sells it. The company predicts a brisk increase in business within the next couple years.

First commercial producer in the U. S. is Columbia-Southern Chemical Corp. which started making it in 1948 under the brand name Chloro-IPC. Their plant is in Barberton, Ohio. In November, imminent larger scale production prompted the company to reduce its carload price from $1.25 to $1 a lb.

▶ **What It Can Do**—The biggest potential use for CIPC is in replacing hand labor to keep cotton fields free of weeds. In the South alone there are 4-5 million acres just waiting for better herbicides to come along.

Certainly CIPC seems to outpoint many of its most promising competitors for the job. Compared to IPC and the dinitros, tests show it gives more dependable weed control with less injury to the cotton. Against crab grass, one of cotton's most insistent weed enemies, it has been found to be better than IPC or 2,4-D and equal or superior to the dinitros. It persists longer in the soil and therefore has longer lasting effects than IPC or the dinitros. It performs better in warm climates and under more variable conditions in general than IPC.

▶ **How It Works**—CIPC can be used as either a pre- or post-emergency spray but it is more effective on most crops including cotton as a pre-emergence spray. It works by retarding cell division in the primary structures of germinating seeds and very young seedlings.

Finished formulations of CIPC containing around 4 lb. of active ingredient per gallon are selling to cotton growers at about $11 to $13 a gallon. Assuming that a farmer may sometimes pay as high as $30 an acre for hoe labor, an expenditure of $5.50 to $6.50 per acre for a half gallon of CIPC formulation is distinctly economical.—*Columbia-Southern Chemical Corp., Fifth Ave. at Bellefield, Pittsburgh, Pa.; U. S. Industrial Chemical Co., 120 Broadway, New York, N. Y.; Monsanto Chemical Co., St. Louis, Mo., Pittsburgh Agricultural Chemical Co., 350 Fifth Ave., New York, N. Y.; American Chemical Paint Co., Ambler, Pa.*

Pentachlorophenol

New free-flowing form improves solution rate.

Pentachlorophenol now comes in the form of irregularly shaped pellets ranging downward in size from ⅛ in. It is produced by Monsanto Chemical Co., by treating regular Santophen 20, the company's pentachlorophenol flakes, with a specially selected oil at a rate of three pounds of oil to 100 pounds of penta.

The new free-flowing form is said to be less dusty, lower in odor and faster dissolving than the parent product.

Used in making wood preservative and herbicide formulations, the new oiled penta has shown in plant tests that it noticeably cuts production time. This is because it dissolves in from ⅓ to ½ the time required for the regular flaked material.

It will be sold in drum quantities only, packed in fiber drums containing 103 lb. of oiled penta, or 100 lb. of pental and three pounds of oil. The price will be the same as that for 100 lb. of regular pental.—*Monsanto Chemical Co., St. Louis 4, Mo.*

Alkyl Phosphites

Potential additives to lubricating oils, stabilizers and plasticizers in cellulosic materials.

A series of alkyl phosphites, all colorless liquids, have recently been put on the market in limited commercial quantities.

They include dialkyl hydrogen phosphites and trialkyl phosphites. In the first group are: dimethyl, diethyl, dibutyl and di-2-ethylhexyl hydrogen phosphites. In the second group are: triethyl, tri-2-propyl, tributyl, trihexyl, tri-iso-oxtyl, and tri-2-ethylhexyl phosphites.

As additives to lubricating oils they are said to be efficient as corrosion inhibitors, stabilizers and anti-oxidants and they reduce wear and corrosion of bearings. They have been suggested as additives to extreme-pressure lubricants to improve viscosity, film-strength, load-carrying capacity and penetrability.

Some of these materials have been found useful as stabilizers and plasticizers in cellusosic materials. Their high solvent action on most organic materials qualifies them for use in many special solvent problems.

The alkyl phosphites undergo selective reactions with organic and inorganic reagents which makes them of possible use in the introduction of phosphorus into an organic molecule. They can be used in the preparation of phosphates, phosphonates, thiophosphates and other organic compounds of phosphorus for use in dyestuffs, pesticides, pharmaceuticals, lubricants and plastics.—*Virginia-Carolina Chemical Corp., Chemicals Div., 401 East Main St., Richmond 8, Va.*

Glacial Methacrylic Acid

For nonaqueous polymerizations and copolymerizations.

Rohm and Hass is now making glacial methacrylic acid in pilot plant quantities. This is in addition to its 90 percent aqueous methacrylic which it has been offering in commercial quantities for some time.

The glacial form is especially useful in nonaqueous polymerizations and copolymerizations. Benzoyl peroxide may be used for polymerization in organic solvents, while aqueous hydrogen peroxide and ammonium persulphate are satisfactory catalysts for polymerization in aqueous medium. Polymerization is conducted preferably at concentrations less than 50 percent.

Esterification and acid chloride formation where water cannot be tolerated are examples of other reactions in which the product is useful.—*Rohm and Haas Co., 235 South 8th St., Philadelphia 5, Pa.*

IN BRIEF—A capsulated listing of this month's newsworthy products

Tertiary-Butylamine

Suggested for use in vulcanization accelerators, oil and grease additives.

Tertiary-butylamine may find use in any reaction where primary or secondary amines of similar molecular weight have been used. Some of the suggested applications are in vulcanization accelerators, oil and grease additives, insecticides, surface-active agents, pharmaceuticals (like antimalarials), corrosion inhibitors, and as catalysts for various reactions.

Now available in development quantities, the low molecular weight t-alkyl, primary aliphatic amine is a clear, colorless to amber liquid which boils at 44-50 deg. C.

Its properties differ from other primary amines of similar molecular weight by virtue of the t-alkyl group directly attached to the nitrogen. Examples of unusual reactivity and properties of t-butylamine include: (1) formation of stable, distillable, monomeric aldimines by reaction with aromatic or aliphatic aldehydes, including formaldehyde, and (2) preparation of stable carbodiimides from its thioureas. Some of its other chemical reactions include alkylation, cyanomethylation, cyanoethylation, oxidation; and the formation of salts, amides, imides, ureas, and thioureas.—*Rohm and Haas Co., Special Products Dept., Washington Sq., Philadelphia 5, Pa.*

Drying Oil

With applications in the manufacture of protective coatings and alkyd resins.

A new drying oil based on linseed oil and styrene should eliminate the necessity for using an oxidized or conjugated oil to produce a styrenated oil.

The new oil is very compatible with other protective coatings materials. Completely miscible with solvents and with refined drying oils, it has limited miscibility with polymerized oils.

Trade named Linstyrol, it is a brilliantly clear oil and produces hard clear films, drying in 15 to 20 hours. Its applications are in the manufacture of protective coatings and alkyd resins.—*Spencer Kellogg and Sons, Buffalo 5, N. Y.*

Thermosetting Resin

Corrects microporosity in metallic castings.

Polyplastex MC, a thermosetting resin has been especially developed to achieve 100 percent filling of microporous voids in metallic castings. Castings are usually impregnated with the resin in a vacuum-pressure tank then put in an oven for curing.

The resin is 100 percent solids. When the liquid resin fills all of the pores, it is said to occupy the same volume after it becomes solid.

It is resistant to a wide variety of solvents, water, salts, hydrocarbons and glycols, as well as acids and weak alkalis. The cured resin can withstand

continuous exposure to temperatures up to 350 deg. F. Although it is hard, the resin is yet resilient enough to allow for expansion and contraction of the metal due to variations in temperature.—*Polyplastex International, Inc., 441 Madison Ave., New York, N. Y.*

Decontaminator of Radioactivity

Easy-to-use cleaner does away with surface contamination.

Numerous tests made by the manufacturer, Enley Products, Inc., have proved the effectiveness of a new cleaner in washing away radioactive surface contamination. The almost neutral pH of the product, called CP Cleaner, makes it usable on the human body and livestock.

In addition to its function of radioactive decontamination, it suggests itself for use as a general industrial and commercial cleaner. Its active constituents dissolve, emulsify and disperse particles of dirt, oil, grease and stains.

It is said to be equally effective in outlying areas because it instantly dissolves in soft, hard and even salt water.—*Enley Products Co., 254 Pearl St., New York, N. Y.*

Teflon Finish

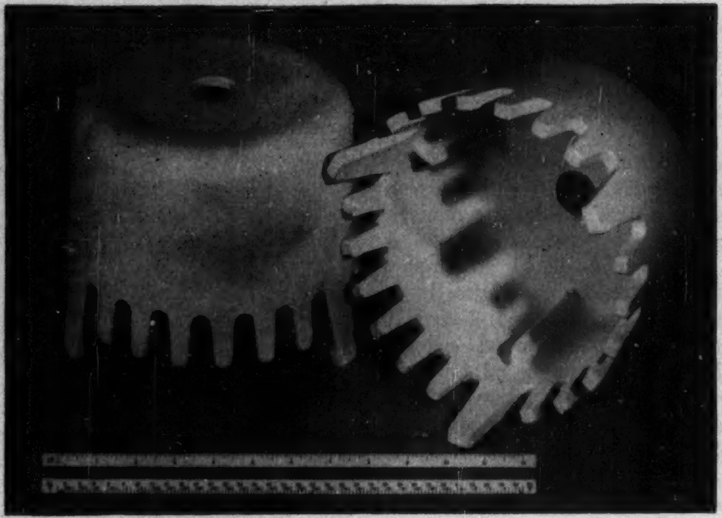
A costly item to combat costly sticking problems.

Sizable quantities of Teflon polytetrafluoroethylene finish are now being produced by Du Pont in Philadelphia.

Nothing will stick to the finish. In some applications, this fact justifies its $75 a gallon cost. In the rubber industry, for example, products are apt to stick to the smoothest metal surfaces and seriously impair equipment operation. Engineers in the packaging industry, or wherever adhesives are used have long been occupied with the problem of glue sticking to machine parts.

The finish is a water suspension of Du Pont-invented plastic which has such a high chemical, heat and mositure resistance it is also used to prevent corrosion of equipment and as electrical wire insulation.

It is an inherently expensive material to produce and will probably never reach a price level that would qualify it as a consumer product. Moreover, the finish must be fused at about 750 deg. F. in special equipment.—*E. I. du Pont de Nemours & Co., Wilmington, Del.*



NEW CERAMIC CAPS IN A VARIETY OF DESIGNS

Ceramic bubble caps are now being made for general use in fractionating and distillation towers where severe corrosion limits the useful service life of metal caps. New manufacturing techniques allow large-scale production of ceramic caps in a variety of designs. Only hydrofluoric acid or strong caustic affect the ceramic which is also hard enough to resist very abrasive conditions. Coors Porcelain Co., 2500 West 7th Ave., Denver 4, Col.

Solvents

Two high boiling compounds can be used in coatings to promote flow, prevent blushing.

Preliminary investigation of the properties of two new compounds show them to qualify favorably as high boiling lacquer solvents. Available for the first time in commercial quantities, they are 3-methoxybutyl acetate and 3-methoxybutyl alcohol.

A colorless liquid, 3-methoxybutyl has a mild odor characteristic of high molecular weight alcohols. Its high boiling range, 157-162 deg. C., and high dilution ratio indicates its usefulness as a retarder type lacquer component.

The use of 3-methoxybutyl alcohol in automotive lacquers is suggested as a replacement for medium boiling alcohols such as normal butyl alcohol. Such a replacement, it is claimed, will permit the use of a greater percentage of low cost, low boiling alcohols.

It has been found particularly valuable as a component of hydraulic fluids. It conforms to the requirements of the Society of Automotive Engineers Specification No. 70 except for evaporation rate and viscosity at high temperatures. An outstanding hydraulic fluid can be prepared by the addition of suitable agents to modify these two properties.

The other compound, 3-methoxybutyl acetate, is described as a colorless liquid with a pleasant fruity odor, milder than the acetic esters of low molecular weight alcohols. Experimental lacquers containing this solvent, boiling at 164-174 deg. C., indicate its effectiveness in retarding blush and as a promoter of flow and high gloss. The suitability of 3-methoxybutyl acetate in automotive and hot spray lacquers has also been mentioned.—*Tennessee Eastman Co., Kingsport, Tenn.*

Liquid-Plastic Coating

Makes industrial fan blades resist moisture, abrasion, fire and corrosion.

A new plastic coating with an acetate-butyrate base has been developed for use on industrial fan blades. Certain chemicals added to the base make for coatings that are tough, quick drying, combustion resistant, easy to apply.

Known as Aeroloid, the coating was developed jointly by the metal products division of Koppers Co. and the

Tennessee Eastman Co. Following stringent tests, it has been adopted for use on all sizes of Aeromaster Industrial Fans made by Koppers which range from 4 to 20 ft. in diameter.

Blades are dipped in the liquid plastic heated to slightly over 100 deg. F. Because of the particular consistency of the plastic at this temperature, it adheres in a smooth, thick coating, yet excess runs off so readily that the final blade finish appears almost like baked enamel, without ridges or runs.

Previous to this application, pure plastic has not been applied to industrial fan blades except in laminate forms. This process required hand-forming of the plastic sheets after they had been softened by solvents, and was exacting and time-consuming.

For use with the new plastic, a primer, completely compatible with the laminated wood of the fan blade and the coating, has also been developed. Tests show that it insures the coating against cracking or crazing under all normal uses.—*Koppers Co., Pittsburgh 19, Pa.*

Adhesives

For bonding vinyl plastics to themselves and to metal, glass and cloth.

Three new products are available which do not require heat, pressure or special surface preparation to bond vinyl plastics to themselves or wood, metal, glass, acrylic plastics, cloth and many other substances.

The first, called CD Cement 201, was developed specifically for bonding vinyl film to itself. It consists of several strong solvents and penetrants. This material is said to be fast acting producing a minimum of curl on thin film as well as a strong bond.

Another, also intended for bonding vinyl film to itself, has a very quick initial bond. A slightly viscous adhesive, it has a very quick initial bond. It is said to be of particular value where fast assembly is essential or for use on rough or poorly-mated surfaces. Called CD Cement 202, it has already proven itself for cementing seams on bags and curtains and many similar applications.

The versatile member of the group is CD Cement 203 for bonding vinyl plastics to metal, glass, paper, leather

"WORTH KNOWING BETTER!"

Heyden
BENZYL CHLORIDES

You'll want to become better acquainted with these Heyden products:

- BENZYL CHLORIDE
- ORTHO-CHLOROBENZYL CHLORIDE
- PARA-CHLOROBENZYL CHLORIDE
- 2,4-DICHLOROBENZYL CHLORIDE
- 3,4-DICHLOROBENZYL CHLORIDE

The uses of Benzyl Chloride in the manufacture of many products—such as quaternary ammonium compounds, dyes, pharmaceuticals, perfumes, plasticizers and resins—are well known. The chlorinated derivatives of benzyl chloride are advantageous starting materials for analogs well worth investigating further.

You probably are already aware of the fact that Heyden has had long experience in producing a wide variety of chlorinated derivatives of toluene and other aromatics. Among these are chlorotoluenes, chlorobenzaldehydes, chlorobenzoic acids, chlorobenzoyl chlorides, and chlorobenzotrichlorides. Our sales and technical staffs will be glad to discuss those of particular interest to you.

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Benzaldehyde • Benzoates • Benzyl Chloride • Bromides • Chlorinated Aromatics
Creosotes • Formaldehyde • Formic Acid • Glycerophosphates • Guaiacols
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Paraformaldehyde • Parahydroxybenzoates • Penicillin • Pentaerythritols
Propyl Gallate • Resorcinol • Salicylates • Salicylic Acid • Streptomycin

and many other surfaces. It produces a quick initial bond and is very fast setting. This is a bodied adhesive and is easily applied by brush, machine, or other conventional methods.

In all three new products, the resins, solvents and other ingredients have been formulated to produce a quick bite or penetration of the surface and a very fast initial tack or bond.—*Chemical Development Corp., Danvers, Mass.*

Insecticide

Researchers find a longer-lasting lindane spray.

By mixing the insecticide, lindane, with a chlorinated polyphenyl, (a resin-like material), research workers have produced a substance that retains its power to kill susceptible insects at least twice as long as do normal lindane sprays. In addition the lindane mixture when applied to a surface develops none of the usual whitish powder deposits, but remains almost invisible throughout its toxic life.

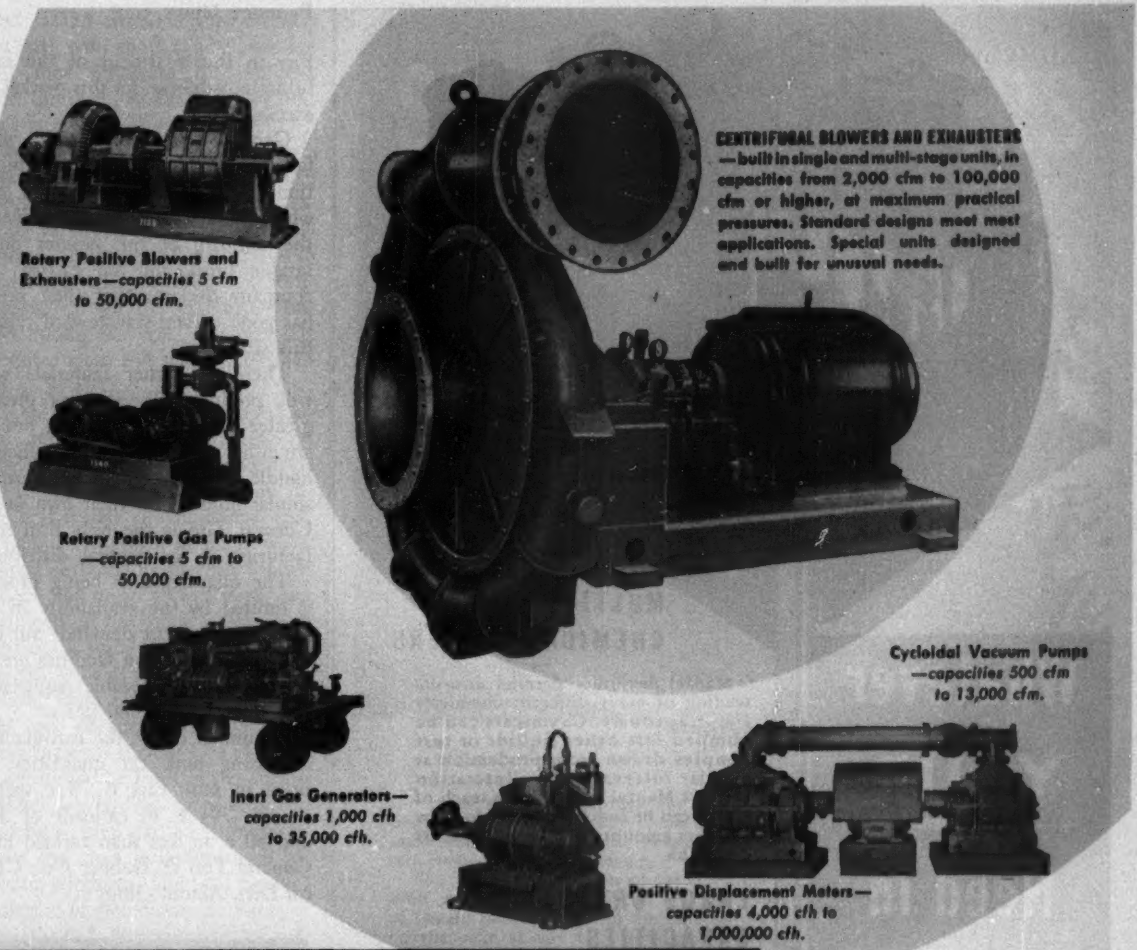
The mixture, used at the rate of 50 mg. of actual lindane per sq. ft., is said to kill 80 percent of all cockroaches exposed for 2 hr. to a 60-day old treated surface. It remained lethal to 66 percent of the roaches after 90 days. Regular lindane sprays, used at the same rate, killed only 4 percent of the roaches after 60 days.—*U. S. Dept. of Agriculture, Washington, D.C.*

Vinyl Pyridine Latex

Enhances adhesion between rubber and rayon or nylon.

Facilities have just been expanded for the manufacture of Gen-Tac Latex, a vinyl pyridine latex. It provides adhesions of rubber to rayon of up to 50 percent greater than have been obtained without its use. Adhesions of rubber to nylon have been found to be about 300 percent better than adhesions obtained by ordinary treating methods.

There is a constantly increasing demand from fabricators of belts, hose and other types of coated fabrics. However, the major portion is being used by the tire industry. The use of nylon in tires is rapidly expanding and since Gen-Tac Latex is almost manda-



WE *Specialize* IN YOUR PROBLEMS OF MOVING GAS OR AIR!

Your business probably *is* different when it comes to handling gas or air. You may want to move a thimbleful of gas—or create a cyclone of whirling air. But, no matter how your problem differs from your neighbor's, the chances are that we've met something pretty close to it, in our almost a century of experience of building such equipment.

Another reason why we know so much about this job is that it's all we do. Our customers range from the "giants of industry" to the neighborhood plant, both of whose production depends upon continuous, reliable, economical performance of air and gas handling units. Because we build the exclusive *dual-ability line* of Rotary Positive and Centrifugal Units, in a wide range of sizes, we offer a *dual choice* not available from any other maker—which permits completely unbiased recommendations.

So—if you have a problem today—or anticipate one a year or five years from now, we suggest you call upon the R-C Specialists—to give you a long-time, satisfactory answer. Write for bulletins on any specific equipment.

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Exclusive Specialists in Handling Gas and Air

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tory in the treatment of the fabric, future possibilities for this market look excellent.

General Tire & Rubber Co., manufacturers of Gen-Tac, started production (up to now on a limited scale) when there was a general problem in the industry of tire failures due to fatigue breaks in the carcass. The company declares that their product has gone a long way toward relieving this situation.

There are other materials which will produce adhesions as great or greater than Gen-Tac Latex but they are either too costly or too difficult to handle. Two other companies make a similar product for their own use but General Tire is the only firm manufacturing it for general distribution.

The quantity now being produced is limited by the availability of vinyl pyridine. Current demands are being met and production facilities are adequate for all foreseeable requirements over the next several years.

A number of the tire manufacturers are using tank car quantities. The price in tank cars is 75 c. per dry pound, 79½ c. in carloads of drums and 80 c. in less than carload lots.—*General Tire & Rubber Co., Chemical Div., Akron, Ohio.*

Insecticides

Twelve million aerosol dispensers containing allethrin were sold during its first full year of production, just past. And a twin bonanza may be on the way.

Future production of the new insecticide allethrin is expected to reach 600 thousand pounds annually. Originally synthesized by the U. S. Dept. of Agriculture in 1949, it has been marketed to the tune of 50 to 60 thousand pounds during its first full year of commercial production.

And USDA chemists have recently come forth with another new insectide which may duplicate this success. Called furethrin, it has many of allethrin's assets and others besides.

A pyrethrin-type insecticide, allethrin provides a quick kill for flies, body lice and mosquitoes (including the malaria-carrying variety). Developed as a pyrethrum substitute, allethrin during the past year was produced in quantities equal to half the pyrethrum imported during the year. Its price has gone down from $55 a lb. in 1950 to $32 a lb. in 1952.

USDA chemists who developed allethrin are following up with tests on another pyrethrim-type insecticide called furethrin. Their test results indicate that it may go commercial fast.

It parallels allethrin in many ways. It is apparently highly specific, though this does not mean it will cover the same insects. It has quick knock-down properties, is suitable for aerosol use and seems to be as safe as allethrin.

Judging from raw material costs, it should be cheaper than allethrin. Starting material for the USDA-developed synthesis for furethrin is furfuralacetone. It's hydrogenated to a furfurylacetone, then carried through essentially the same procedure used for producing allethrin. The final product is a mixture of stereoisomeric esters of the pyrethrin I, distinguished by a 2-furfuryl side chain.—*U. S. Dept of Agriculture, Agricultural Research Administration, Washington, D. C.*

Seed Disinfectant

Chemically coats seeds to protect against diseases causing rot, blight.

Du Pont has just reported the success of a third round of yearly field tests on a chemical seed disinfectant for grass and legumes. The chemical, an organic sulphur compound known as Arasan, is said to coat seeds and ward off disease organisms in the soil or on the seed coat.

In the latest tests, as with their predecessors, there were marked increases in stand of the treated crops as against the untreated. For example, here are some typical increases: alfalfa, 32 percent in 60 tests; red clover, 61 percent in 27 tests; sweet clover, 108 percent in 4 tests; lespedeza, 53 percent in 11 tests.

Increased stands did not tell the

entire story. Since the chemical allowed the plant to get its start in life free of disease, healthier root systems and faster growth were frequently noted in comparison with plants from untreated seed. In cases where the crop is raised for hay, this can very definitely mean more bales per acre.

Growers may either buy Arasan itself and treat their seed before planting, or have the seed treated mechanically by local seed firms. A number of the larger seed companies now offer seed for sale which has been treated. In all cases, treatment costs only one or two cents per pound of seed.—*E. I du Pont de Nemours & Co., Wilmington, Del.*

Phosphate Coatings

Form crystalline inorganic insulating layers between metals and paints.

A new line of five products is said to fill every conceivable phosphating requirement. These materials are:

Turcoat 3540—for a thin, smooth, tight phosphate coating on iron, steel or zinc as a bond for paint or metal drawing. Applied either by spray or by dip.

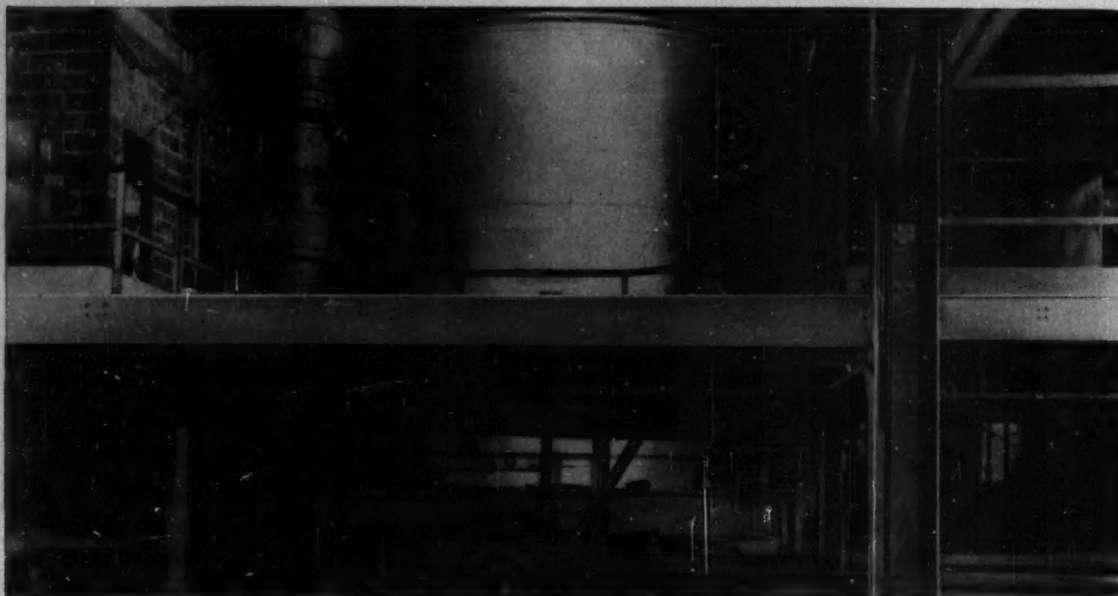
Turcoat 3520—for a substantial phosphate coating on iron or steel as a foundation for oil, paint or other organic finishes. Applied by dip.

Turcoat 3420—to clean and passivate iron and steel in one operation, improving paint adhesion. Applied by spray or dip.

Turcoat 3557—for substantial phosphate anti-friction coating for iron or steel moving parts. Applied by dip.

Turcoat 3560—for chemical coating on terneplate and other difficult-to-coat non-ferrous metals as a bond for paint. Applied by spray or dip.

The phosphate coatings are deposited by what are known as Turcoat processes. The coatings are nonconducting, are resistant to moisture and chemical changes. Thus, conditions that cause electrolytic corrosion are eliminated. Rust is inhibited to the point where oxidation, occurring at an exposed area where paint has been abraded, will not creep beneath the painted surface.—*Turco Products, Inc., 832 East 62nd St., Los Angeles 1, Calif.*



REACTOR can use low-grade ore to produce . . .

SO_2 by Fluidization

A CHEMICAL ENGINEERING PICTURED FLOWSHEET

Within a short time, eight different paper mills and four sulphuric acid manufacturers will be operating fluidized bed systems to supply major portions of their vital SO_2 from pyrite or pyrrhotite.

First commercial installation to produce sulphur dioxide gas by roasting a fluidized mass is now in operation at the Berlin, N. H. mill of The Brown Co., pulp and paper manufacturers. This unit (see accompanying flowsheet and pictures) was started up in the spring of 1952. The process was developed by The Dorr Co., Stamford, Conn.

Significance of this development is that it makes available new sources of sulphur dioxide, which is welcome to those who have faced cut-backs in their supply of elemental sulphur. Sulphuric acid manufacturers and pulp mills are particularly interested.

Pulp manufacturers prefer a high concentration of sulphur dioxide in their gas, as a stronger cooking acid results.

The Brown Co. installation consistently roasts pyrrhotite to produce a gas strength of 13 percent sulphur dioxide. 15 percent sulphur dioxide would be expected were pyrite the raw material. This compares with 18 percent for conventional sulphur burners, although some of these operate to produce a gas having a sulphur dioxide content as low as 12 to 14 percent.

The theoretical maximum sulphur dioxide concentration resulting from the roasting of pyrite is 16.5 percent:

$$FeS_2 + 2.67\ O_2 + 10.1\ N_2 \rightarrow 1/3\ Fe_3O_4 + 2\ SO_2 + 10.1\ N_2$$

With pyrrhotite, the theoretical maximum is 14.4 percent:

$$Fe_7S_8 + 12.7\ O_2 + 47.7\ N_2 \rightarrow 7/3\ Fe_3O_4 + 8\ SO_2 + 47.7\ N_2$$

Fluidized units in general are capable of converting over 96 percent of the sulphur in either pyrite or pyrrhotite to sulphur dioxide with less than 10 percent air.

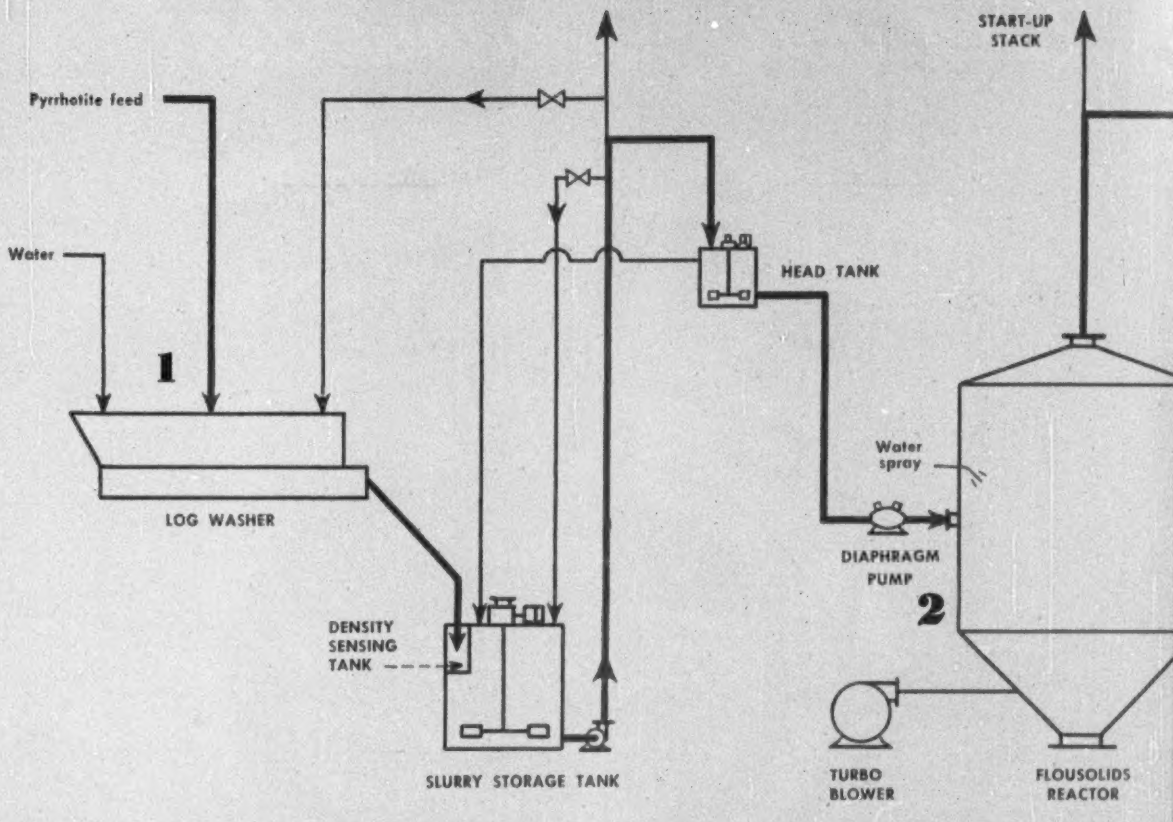
Pyrrhotite for The Brown Co. installation comes by rail from The Vermont Copper Co., about 100 miles away. At Vermont, the pyrrhotite (discarded copper tailings) is concentrated by flotation. It reaches Berlin at about 9-10 percent moisture, and contains minor impurities. About 75 tpd. of pyrrhotite is consumed.

First step in the process at Berlin is diluting to a pumpable slurry (75 percent solids) with controlled amounts of water.

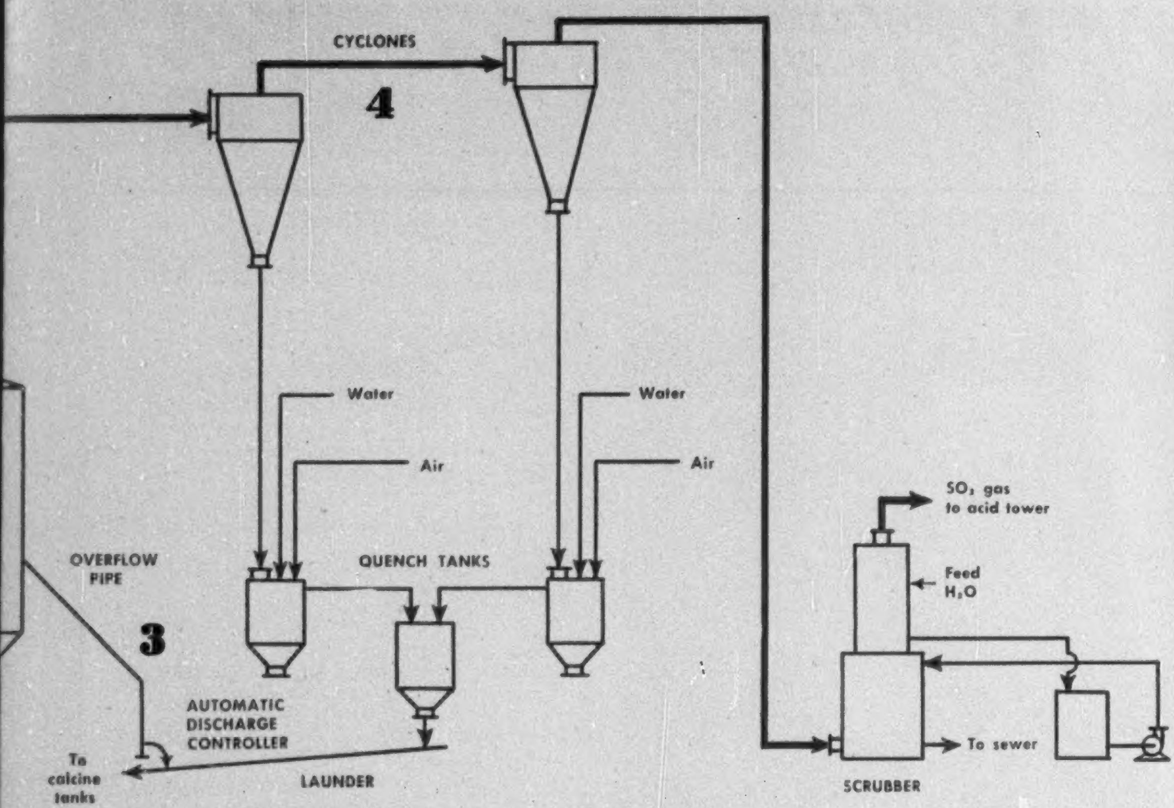
A diaphragm pump feeds this slurry to the reactor. The heat from the highly exothermic reaction, which is controlled at 1,600-1,650 deg. F., evaporates the water almost immediately. The slurry is met by an upcoming stream of air moving at 1 fps. and 3,600 cfm.

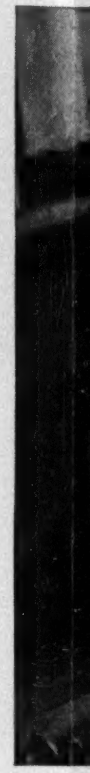
To keep the iron oxide from sintering, an automatically controlled stream of water is added to the bed.

The fluidized bed does a remarkable job of rapidly mixing the slurry, upcoming air, and water from the spray. The temperature will not vary more than 20 deg. F. throughout the bed.



1 This bucket crane delivers pyrrhotite in the form of 10 percent moisture filter cake to this log washer, where it is repulped to a controlled density of 70 percent to 75 percent solids.





3 Aut
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2 Fluo Solids reactor. Pyrrotite pulp of a density of 2.3 is conveyed at the rate of approximately 8.4 gpm. by means of the diaphragm pump at the left from the head tank into the reactor.

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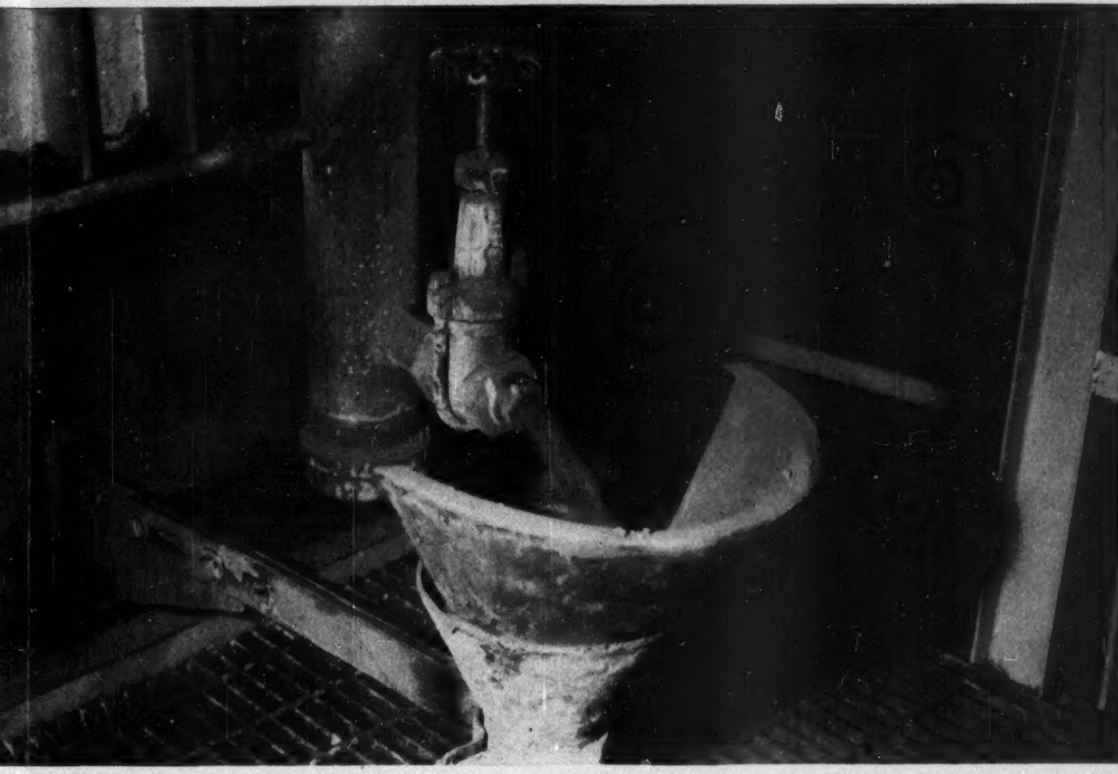
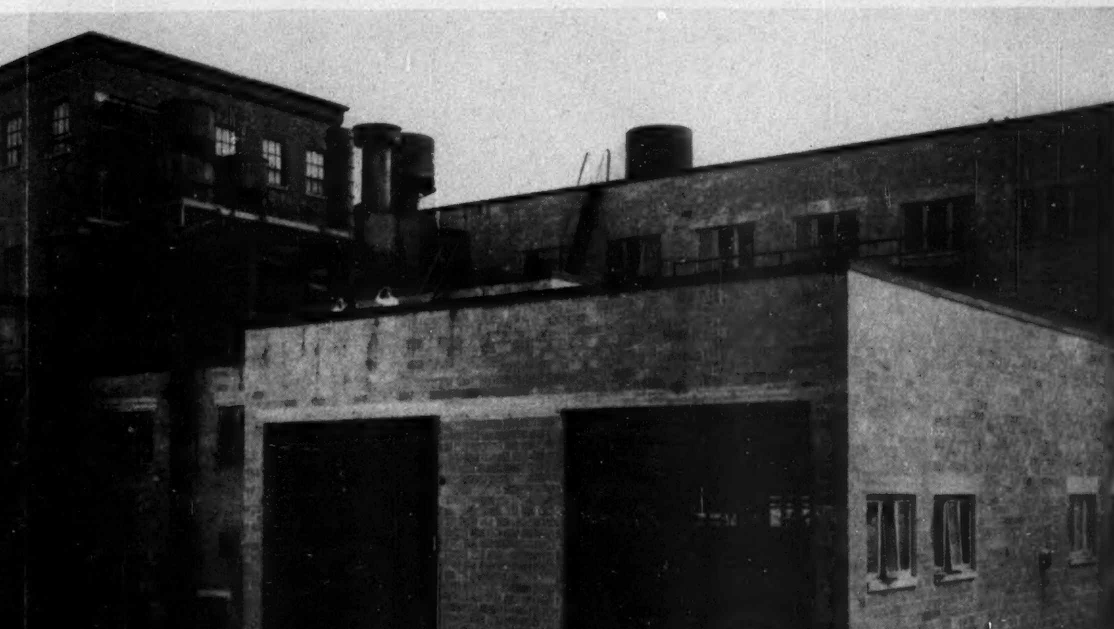


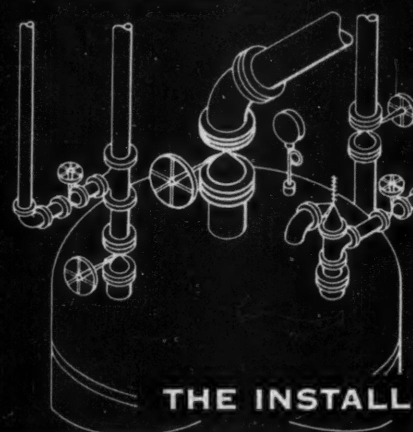
Automatic tee-discharge controller which together with the overflow pipe regulates the bed height at approximately 5 ft. A launder sends the discharge to the calcine tanks.



Two-stage cyclone system at upper left of this picture collects the dust from the fluidized bed of the reactor. Each stage consists of two cyclones in parallel, followed by a scrubbing tower.

Are You Getting this Low-Cost Alloy Valve Service?

...on Starch Converters, for instance



THE INSTALLATION

Crane Ni-Resist valves on starch inlet lines to converters, Corn Products Refining Co. plant, Argo, Ill.

VALVE SERVICE RATINGS

CORROSION-RESISTANCE: Ni-Resist OK—18-8 Mo trim ideal

SUITABILITY: Good for this mildly corrosive service

MAINTENANCE COST: None—except routine stuffing box

SERVICE LIFE: 5 times longer to-date than other valves

OPERATING RESULTS: Much less process interruption

PRICE: In line

AVAILABILITY: Regular Crane Catalog item

THE HISTORY

Valves in this service are constantly exposed to hydrochloric acid vapors under working pressure of 50 psi at approximately 280 deg. F. None of the valves formerly used lasted more than 2 to 3 weeks without repairs. In 3 to 4 months they had to be retired from service for rebuilding. Maintenance costs were excessively high.

To stop the trouble, the plant chose Crane Ni-Resist Alloy Cast Iron Gate Valves with Crane 18-8 Mo trim. Since being installed, these valves have operated at highest efficiency. On last inspection after 19 months' uninterrupted service, they were still in excellent condition.

THE VALVE

Crane Ni-Resist Cast Iron Gate Valves combine, at moderate cost, the physical properties of quality cast iron with substantially greater resistance to corrosion, erosion, and wear. With 18-8 Mo Alloy trim, they step up valve efficiency on many chemical process services where common cast iron is inadequate. For recommendations, see your Crane Catalog, or call your Crane Representative.

The Complete Crane Line Meets All Valve Needs. That's Why More Crane Valves Are Used Than Any Other Make!

CRANE VALVES

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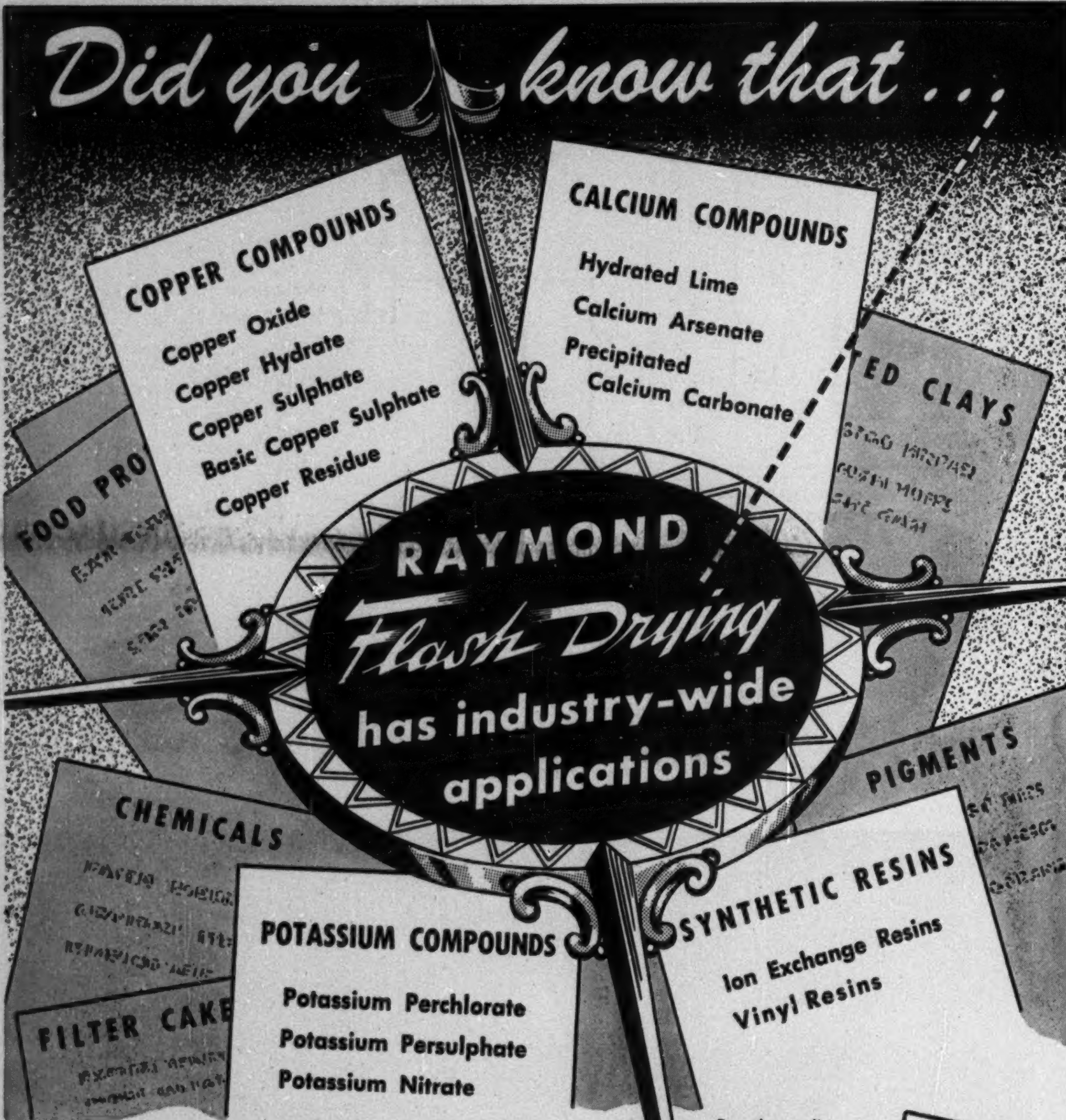

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This modern method offers you the following important advantages:—
Low first cost . . . ease of installation . . . automatic operation . . . close product control . . . clean dustless system . . . frequently a higher quality of finished product . . . economical maintenance . . . and long dependable service.

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GUIDED TOUR CONTINUED

Want to be a big flop?

Then you'll certainly have to learn to write verbose, pompous, pussyfooting letters to un-sell yourself and your idea. Here's how *(You & Your Job)*.

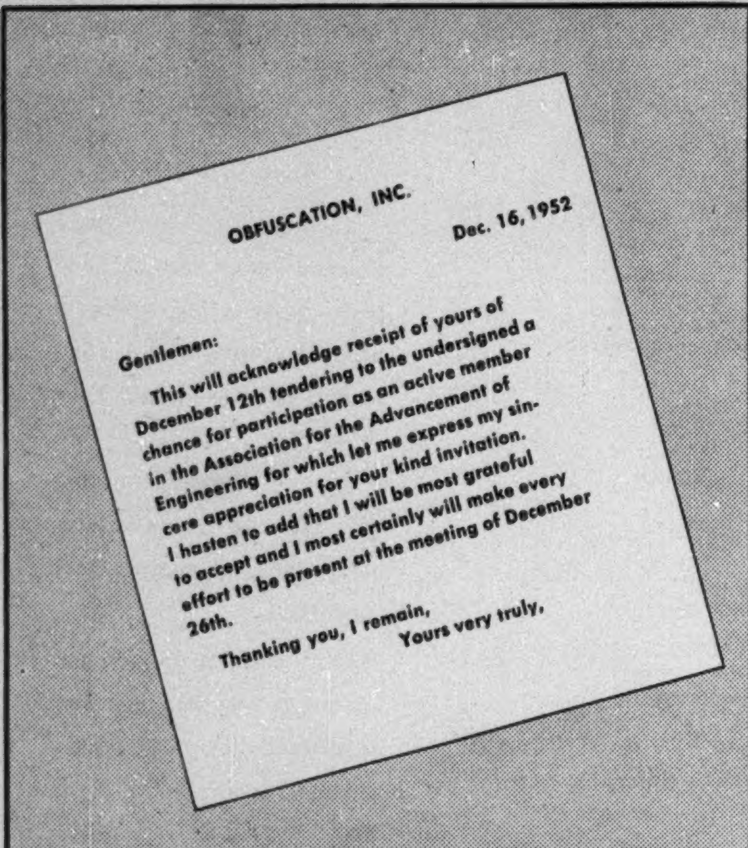
How styrene co-polymers stack up against 165 corrosives.

High-impact polystyrenes are now coming into their own as materials for pipes, fittings and other equipment. Here is your chart checklist of how they stand up against 165 chemical corrosives *(Corrosion Forum)*.

Novel solids feeder

. . . shows how non-fluidized solids might be fed into a fluidized bed reactor. Standard Oil Development says it can be done with air *(Tomorrow's Technology)*.

AND—Advertisers' Index precedes your Reader Service section inside the back cover.


OBFUSCATION, INC.

Dec. 16, 1952

Gentlemen:

This will acknowledge receipt of yours of December 12th tendering to the undersigned a chance for participation as an active member in the Association for the Advancement of Engineering for which let me express my sincere appreciation for your kind invitation. I hasten to add that I will be most grateful to accept and I most certainly will make every effort to be present at the meeting of December 26th.

Thanking you, I remain,

Yours very truly,

MODEL of good, solid Victorian prose. Learning to write like this is easy.*

How to Write Poor Letters

Some people think that chemical engineers don't write many letters. In some cases, that's true; in other cases, it's only a devout wish. Letters are an executive's lifeblood, a technical salesman's "open sesame," a market researcher's pipeline, a consultant's recommendation, a research man's liaison with his peers.

Even the engineer who writes one letter a month could write the letter that brings in a million dollar sale—or loses it; that gets him a $15,000-a-year job—or loses it.

* Some befuddled modernists would have us believe that this would be a better way to write the letter above:
Dear Mr. Hamilton:
Thank you very much for inviting me to join the Association for the Advancement of Engineering. I appreciate your invitation and accept with real pleasure.
I'm looking forward to attending your meeting this Friday. Again, many thanks.
Sincerely yours,

So you don't write letters that set the world on fire. Take heart, dear fellow friend of the Reynolds number. You and I are in good company. The vice-presidents of the million dollar companies often don't do any better than we do.

One consultant on business letters[1] has concluded that only one person in 50 has a natural talent for letter writing. He says businessmen (including engineers) write 10 to 15 percent more letters than they'd have to if they were clear and explicit in the first place; most letters, he points out, are 30-60 percent longer than they'd be if all the clichés and trite expressions were thrown out and plain English substituted.

Since you and I aren't likely to be the one person in fifty with a natural talent for good letters, let's not be content with a run-of-the-mill quality of mediocrity. Instead, let's make every epistle we write not just a poor job but an outstandingly poor job. Here's how.

► **Treat Him Like an Imbecile**—Let's suppose that two days ago a fellow engineer sent you a report entitled: "Proposed Cost Estimate for a 30,000 Barrel-Per-Day Coal Hydrogenation Plant to be Located in Coaltown, Kentucky" and he asked you to comment on it. You wouldn't start your return letter with something like: "That was a good job you did on your cost report. I agreed with all the figures except . . ."

No. Never.

To do a really poor job you'd have to start your letter with: "This writer has just received your report entitled: "Proposed Cost Estimate for a 30,000 Barrel-Per-Day Coal Hydrogenation Plant to be Located in Coaltown, Kentucky."

After all, your reader only sent his report to you a few days ago. He can't be expected to remember the title of that report or the fact that he asked you to comment on it. Certainly if you had called him on the telephone you would have said: "Mr. Smith, I have just received your report entitled: 'Proposed Cost Estimate. . .' " So remember rule number two: "Treat Your Reader Like a Simple-Minded Oaf."

After you've insulted your reader your job is to confuse him. So, first ask yourself: What is this letter supposed to do? Get me a job? Get information? Get advice, corroboration, or approval? Sell something?

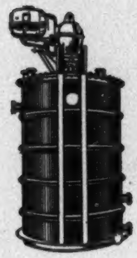
When you've decided the action your letter is trying to produce, try to get a picture of the agent—the person—who will produce the action.

Is he an emotional being like Shakespeare's Shylock with "thoughts, feelings, passions, desires?" Or is he the type of person who is likely to insist on a retraction if you say "Good Morning!" when, in fact, it's a rainy morning. This is really an academic question because, if you follow the rules in this article, your letters will always

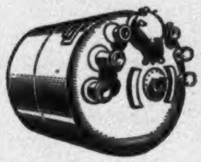
(Continued)

HAYNES Alloy Sheet and Plate

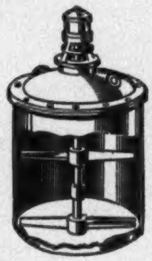
Trade-Mark



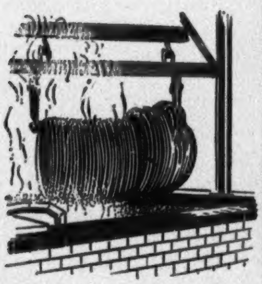
Evaporators



Autoclaves



Agitators



Pickling Equipment

For SEVERE SERVICE conditions

You can obtain sheet and plate of four different HAYNES alloys, all specially designed to combat certain severe service conditions, for the fabrication of processing equipment. The alloys are all strong and highly resistant to heat, oxidation, and chemical corrosion. The chart below will give you an idea of where each is most commonly used.

HAYNES alloy sheet and plate have been used successfully for many different types of fabricated equipment. Typical applications include reaction vessels, condensers, autoclaves, heat exchangers, evaporators, dryers, mixers, agitators, fans, and blowers. The alloys can be fabricated by deep drawing, spinning, pressing, forming, and welding.

All four HAYNES alloys are supplied in hot-rolled sheet and plate in thicknesses of 1 in. down to 24 U. S. Std. (0.025 in.). These materials are furnished annealed and pickled with a commercial No. 1 finish. If you wish further information about HAYNES alloy sheet and plate, contact the nearest Haynes Stellite Company district office.

USE SHEET OR PLATE OF	FOR RESISTANCE TO
HASTELLOY Alloy B (nickel-molybdenum-iron)	Hydrochloric acid, wet hydrogen chloride gas, sulphuric acid, phosphoric acid, organic acids, high temperatures.
HASTELLOY Alloy C (nickel-molybdenum-chromium-iron)	Nitric acid, free chlorine, acid salts, hydrochloric acid, sulphuric acid, phosphoric acid, organic acids, sulphurous acid, high temperatures.
MULTIMET Alloy (cobalt-chromium-nickel-iron)	Oxidation, high temperatures.
HAYNES Alloy No. 25 (cobalt-chromium-tungsten-nickel)	Oxidation, high temperatures, carburization, wet chlorine, nitric acid.

HAYNES
TRADE-MARK
alloys

Haynes Stellite Company
A Division of
Union Carbide and Carbon Corporation
UCC
General Offices and Works, Kokomo, Indiana
Sales Offices
Chicago — Cleveland — Detroit — Houston
Los Angeles—New York—San Francisco—Tulsa

"Haynes," "Hastelloy," and "Multimet" are trade-marks of Union Carbide and Carbon Corporation.

Good Stock Phrases	Instead of
Due to the fact that	Because
Make a correction in	Correct
Under date of	On
Along the lines of	Like
With regard to	About
Give consideration to	Consider
In the event of	If
Inasmuch as	Since

The Long . . .	. . . And the Short of It
Demonstrate	Show
Utilize	Use
Procure	Get
Forward	Send
Terminate	End
Prognosticate	Predict
Request	Ask
Communication	Letter
Facilitate	Help
Endeavor	Try

be impersonal—but more on that later.

After you've got a clear idea of your reader and what you'd like him to do, you can begin confusing. There's one sure way to do this:

▶**Don't Organize Your Thoughts**—Begin dictating or scribbling immediately. Your thoughts will begin to organize themselves when you're halfway through your letter.

Meanwhile you can pass the time dictating or writing the stock phrases like "We respectfully submit." "We are of the opinion . . . to the best of our knowledge," and the like.

Your reader won't be able to criticize you for what you say because he won't know what it is you are saying.

Another thing to remember is this:

▶**Show Your Insincerity**—Especially if you've got a selling job to do. If you're writing sales letters or letters of a promotional or institutional flavor, be sure to present only your side. Think like a political demagogue and assume that no one but an addlepated idiot could have views or convictions opposing yours.

Call your product, your company, your process "the best," "the ultimate," "incomparable." For isn't it true that the competitor's company is manned by the inmates of Bellevue in their spare time?

If anything technical is involved in your presentation, don't try to explain it. Makes it easy. Call it a "miracle" product, ingredient or what have you. After all, it's not uncommon for God to come down from heaven and create "di-methyl gobbledegook" for some chemist to put in a new toothpaste.

So be sure to insult your reader's intelligence with extravagant claims and assume that he will be awaiting your point-of-view with baited breath. Surely he wouldn't have any opinions or convictions of his own!

Also high on the list is this advice:

▶**Be Pompous and Pussyfooting**—A while ago, Phil Swain, editor of *Power*, had a little fun rewriting Shakespeare's Mark Anthony speech from Julius Caesar as an engineer (or a businessman) might have done it. You'll remember that Shakespeare starts:

"Good friends, sweet friends, let me not stir you up
To such a sudden flow of mutiny
They that have done this deed are honourable!
What private griefs they have, alas! I know not,
What made them do it; they are wise and honorable,
And will, no doubt, with reason answer you . . ."

Now let's look at the "right" way to do it—the way an outstandingly poor letter writer would have done it.

"It is not the intention of the speaker to create in the minds of the friends and other gentlemen present any rapid increase in antagonistic and violent emotions. The persons who sustain the responsibility for this action are gentlemen of substantial reputation. It has not been feasible for the speaker to determine what personal grievances may have impelled them to concur in the action under discussion. However, due to the fact that they are intelligent and of satisfactory reputation, it may be assumed that they will stand prepared to present apparently defensible explanations of their procedure."

There's more, but that excerpt ought to be enough to show how it's done.

Next, here's rule number five:

▶**Be Dull and Impersonal**—For instance, if you're writing to Mr. Jones, never, never, repeat his name in the body of your letter. Remember he hates the sight of his own name—especially in print. So be sure to limit any personal mentions to your salutation and close.

After all, this isn't a case of one man exchanging information and ideas with another man the way it's done in a telephone call. This is material for the record—material that's likely to remain in somebody's file drawer for years.

You may be a warm and friendly person to your wife, children and close associates, but to the people you exchange letters with you'll be just an automaton in some corporate structure—as is fitting and proper.

The next rule is absolutely indispensible to success.

▶**Think in Clichés**—Somebody's got to keep the stationery suppliers in business.

Don't say: "Thank you for your letter of August 6. My opinion is that . . . "

Instead, try something like this: "I am in receipt of your letter dated August 6, 1952, and after careful perusal of all the statements therein, I am of the opinion that . . ." Sounds much better. More important and dignified. Next, follow through with such expressions as: "I have recently been in conference with Mr. Smith," instead of "I was talking to Joe Smith the other day."

Trite expressions make letter writing easy. A fellow doesn't have to think at all—merely spout one bromide after another into a dictating machine and—"Voila!"—a complete letter emerges. There's no danger that "you" will intrude into such a letter either, for it will have the odor and impersonality of a legal document with

---

The editors wish to credit and thank General Foods Corp. and their book "Effective Business Letters" which was the source of the illustrative material on this and the page preceding.

NO SIZE TOO LARGE... NO SERVICE TOO TOUGH...

for "KARBATE" BRAND HEAT EXCHANGERS

SIZE. There is virtually no limit to the amount of heat-transfer surface obtainable in "Karbate" impervious graphite shell-and-tube-type heat exchangers. Large capacity requirements are readily met, either by a combination of standard Series 310A and 90A "Karbate" heat exchangers or with special units manufactured by the country's leading producers of heat exchange equipment.

SERVICE. There's ample evidence that "Karbate" heat exchangers already occupy an important place in practically every type of severely corrosive service. For example, among suppliers of heat-transfer equipment for the process industries, there are 57 manufacturers and service organizations who now depend on "Karbate" impervious graphite equipment to solve their customers' toughest corrosion problems!

Write for Catalog Section S-6740— New Standard "Karbate" Heat Exchangers

DOLLARS *and* SENSE

. . . point to "Eveready" No. 1050 Industrial Flashlight Batteries . . . the cells that deliver *twice as much* usable light as any battery we've ever made before. Their unique construction prevents swelling or jamming in the case... has no metal can to leak or corrode.

The terms "Karbate" and "Eveready" are registered trade-marks of Union Carbide and Carbon Corporation

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A Division of Union Carbide and Carbon Corporation
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District Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco
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HYDROCHLORIC ACID ABSORBERS · STRUCTURAL CARBON · BUBBLE CAPS · BRICK · GRAPHITE ANODES · BRUSHES

20 Good Fog Phrases*

1. We have duly received your letter of
2. Reference is made to your letter of
3. Should like to take this opportunity
4. Has come to the notice of the writer
5. Are respectfully submitting herewith
6. On the occasion of your recent visit
7. Like to offer for your consideration
8. This is to reply to your letter of
9. We are hopeful for the possibility
10. The writer is inclined to believe
11. It should not be considered that
12. It is perhaps not unreasonable
13. In accordance with your request
14. The opinion was expressed that
15. To explore the possibilities of
16. Thus, it should be noted that
17. We feel that it is desirable
18. While it is not to be denied
19. While it may be argued
20. Such was the nature of

*A fog phrase is one which a writer can use without giving much, if any, thought to what he is trying to say. It is designed to "fog" the reader's mind.

such words as "party" for "person," "secure" for "get," "numerous" for "many," and the like.

Remember, the tougher it is to read the more important it sounds.

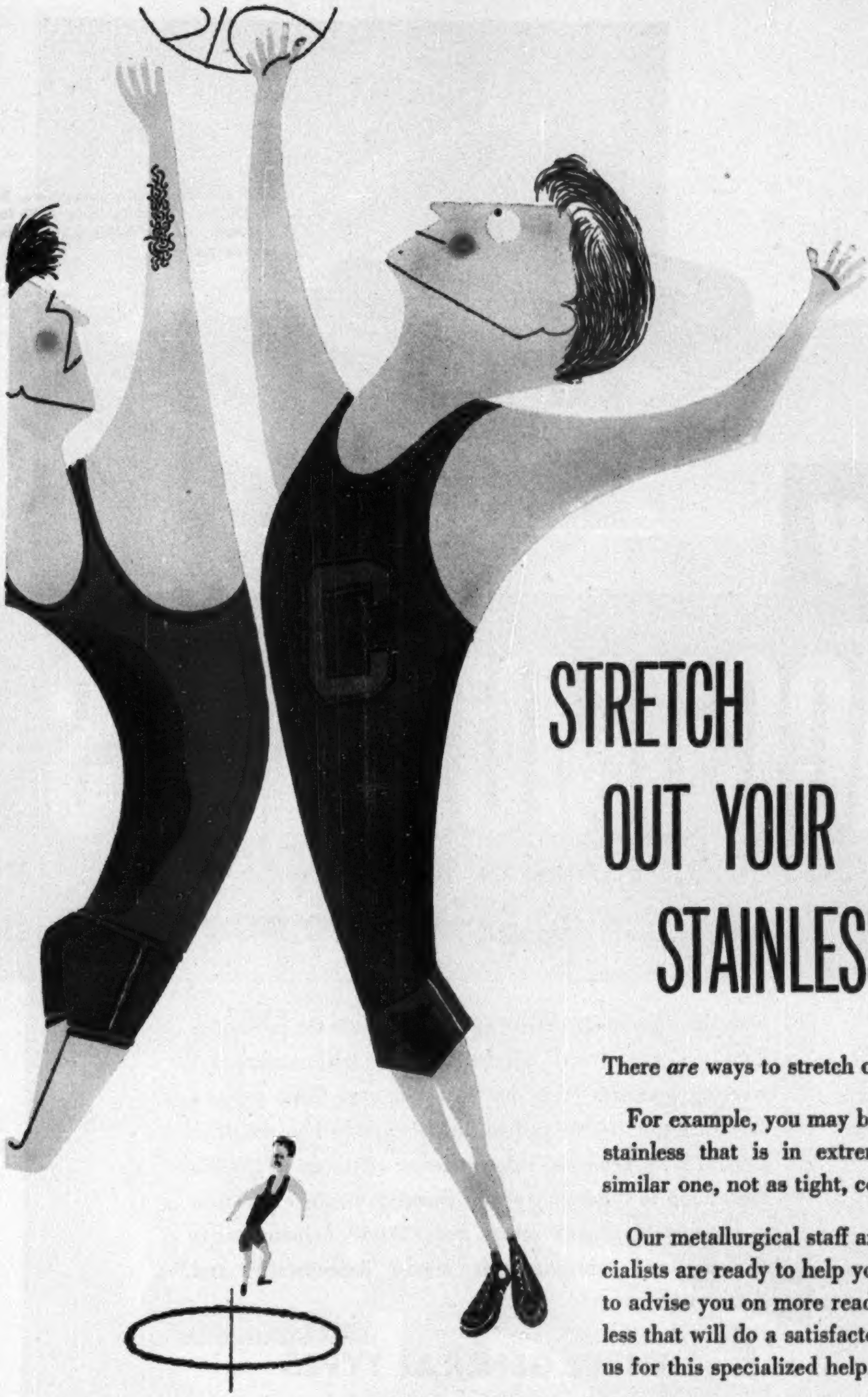
▶ **Never Show Humor**—Never, under any circumstances. The man you're writing to is bound to be a pompous fellow without any interest in the lighter things of life. After all, our America is the land where individuals like Will Rogers are always tarred and feathered and radios are invariably clicked off when a Jack Benny takes to the air.

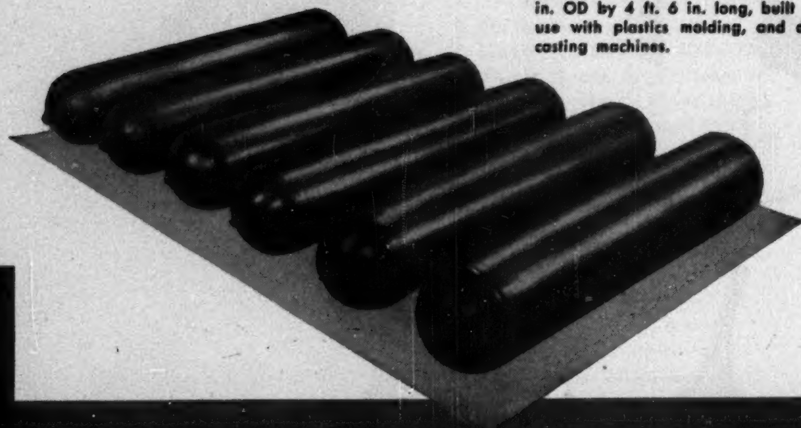
A final, sure way to make your letters dull is to:

▶ **Use Very Long Paragraphs**—The rule here is no more than two paragraphs per page. Of course, each of these paragraphs should contain at least a dozen different ideas. Long sentences are a must too. Periods should be shunned like the Anopheles mosquito—and be just as rare. Instead, use semicolons and colons often and earnestly.

Simple attention to the few rules laid down here is guaranteed to make you an outstanding failure as a writer of letters.

If it doesn't, not only will the \$1.00-1.25 your company spends on each letter be cheerfully refunded, but we'll also send you without charge or obligation, a special gold-plated edition of the celebrated "circular file," that justly useful repository for mediocre business letters.





Spun-end hydraulic accumulators, 14 in. OD by 4 ft. 6 in. long, built for use with plastics molding, and die-casting machines.

B&W ACCUMULATORS

. . . 500 to 6,000 psi or higher— 5 gallons to 10,000 gallons

Now serving a broad variety of applications in the processing industries are several hundred B&W Accumulators for working pressures from 500 to as high as 6,000 psi and capacities up to 10,000 gallons. Installations include the three general types described below. Recent additions to B&W's fabricating facilities may permit extension of these pressures to considerably higher values. Every B&W Accumulator is designed and fabricated for utmost dependability and service life.

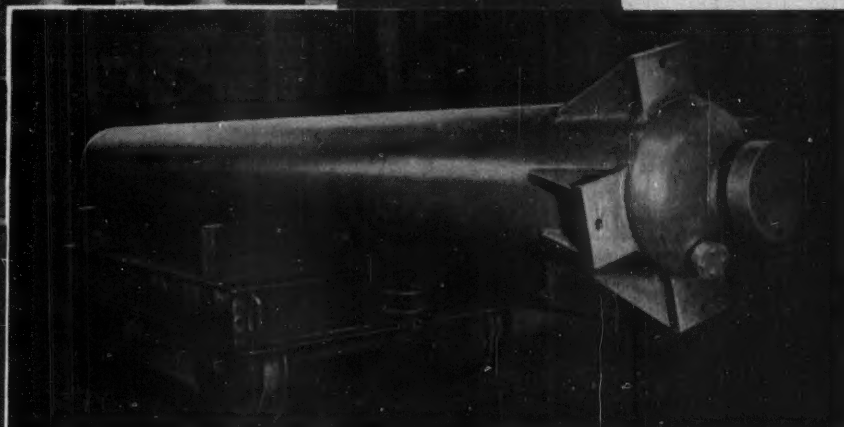
THREE GENERAL TYPES

SMALL ACCUMULATORS in capacities of 5 to 120 gallons for working pressures of 500 to 5,000 psi.

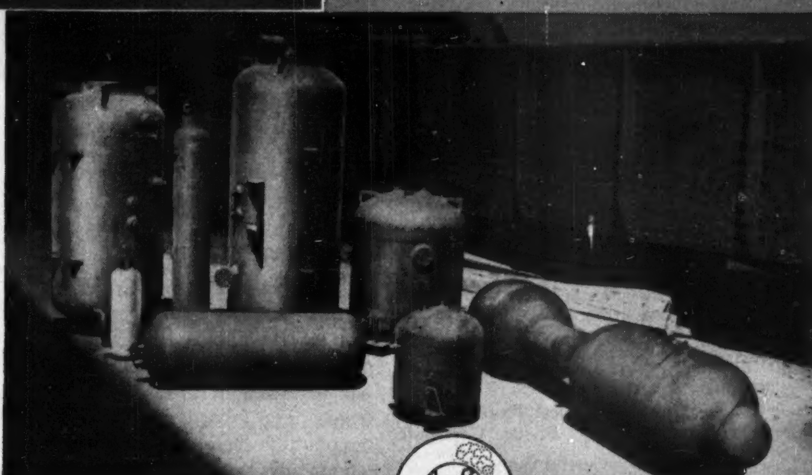
MEDIUM ACCUMULATORS of solid plate construction, in capacities of 120 to 10,000 gallons; working pressures up to 3,000 psi.

LARGE ACCUMULATORS of B&W banded construction, in capacities from 200 to 9,000 gallons for 2,000 psi and over.

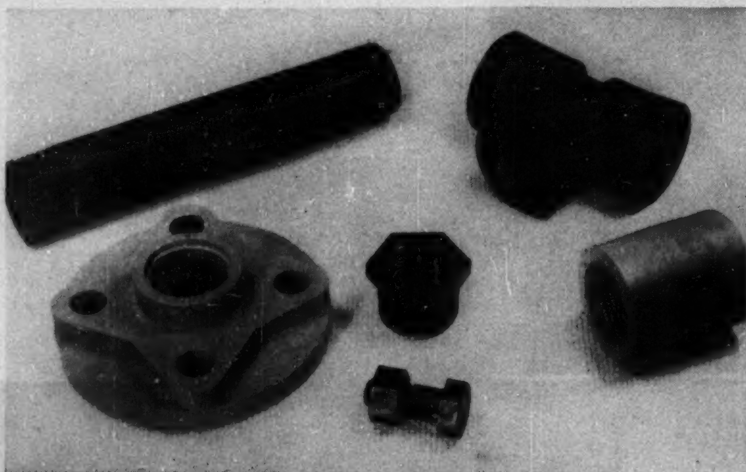
Banded accumulators, [illegible] high and 5 ft. OD for a hydro-pneumatic pressure system.



Solid plate accumulator, 22 in. [illegible] by 2-3/16 in. shell by 21 ft. 3 [illegible] for 600 gallons with a working pressure of 3,000 psi.



Variety of small accumulators for 2,000 psi requirements on military equipment.



High Impact Styrene Copolymers

The corrosion resistance of these newly-developed materials of construction to a number of corrosives, with physical properties, forms available, and applications.

RAYMOND B. SEYMOUR & ROBERT H. STEINER
The Atlas Mineral Products Co., Mertztown, Pa.

Polystyrene has long been noted for its excellent molding characteristics, but its brittleness has precluded its use as a material of construction for the chemical process industries. In the past few years, copolymers of styrene with minor amounts of other monomers such as butadiene, acrylonitrile and isobutylene and blends of these products with various elastomers have made possible the so-called high impact polystyrenes. Outstanding among these are mixtures of a styrene-acrylonitrile copolymer and a nitrile rubber. These low density plastics exhibit extreme toughness, moldability, and good chemical resistance.

PIPE AND FITTINGS

Perhaps the largest use of high impact styrene copolymers in the chemical industry is in the form of extruded pipe. This rigid plastic pipe is available commercially in standard iron pipe sizes of ½, ¾, 1, 1½ and 2 in. With properly designed pipe, working pressures as high as 100 psi. are permissible at temperatures of 80-120° F. Where higher working pressures are necessary, extra heavy walled or armored pipe can be made on special order. Standard pipe fittings such as flanges, couplings, elbows, tees and caps molded of the same materials are also available. Styrene copolymer pipe can be bent by heating in an oven and forming around standard pipe bending forms.

FABRICATED STRUCTURES

Corrosion resistant structures such as tanks, tank liners, tank covers, fume hoods, collectors, ducts and other equipment for the process industries have been fabricated from high impact styrene copolymers. The usual techniques used for the manufacture and fabrication of rigid polyvinyl chloride or polyethylene sheets cannot be used since high impact styrene copolymers are not adaptable to heat welding or calendering processes. Molded sheets in ⅛ in. and ¼ in. thicknesses are available commercially. Special shapes can be made by heating a sheet above its softening point and forming over suitable male molds. Structures based on these materials are produced by solvent welding or cementing the component parts using extruded angles and channels to form corners and joints.

Physical and Mechanical Properties of a Typical High Impact Styrene Copolymer

	ASTM Test No.	
Tensile strength	D638-49T	5,000 psi.
Flexural strength	D650-42T	10,000 psi.
Modulus of elasticity	D650-42T	400,000 psi.
Hardness, Rockwell R	D785-44T	100
Impact strength, Izod	D256-47T	8 ft.-lb./inch
Compressive strength	D695-49T	10,000 psi.
Thermal expansion	D864-45T	3.7×10^{-5} in./in. —°F.
Water absorption	D570-42	0.3%
Specific gravity	D792-48T	1.07
Dielectric constant, 60 cycles	D149-44	4.0
Power factor	D150-47T	0.05
Heat distortion temperature	D648-45T	185° F.
Maximum operating temperature	—	170° F.

MOLDED ARTICLES

The styrene copolymers are used for the production of many small corrosion resistant articles for the chemical and textile industry. Typical applications are textile equipment such as spools, quills and shuttles, filter and flow-regulator parts, sprayer nozzles, supports in plating baths and water conditioning equipment components.

MACHINABILITY

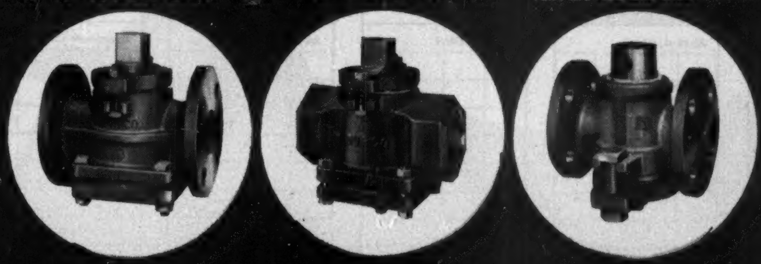
Extruded or molded shapes can be machined and finished with ordinary machine shop equipment. The common operations of sawing, shearing, drilling, tapping, turning, routing, sanding, threading, etc., are easily carried out when allowances are made for the thermoplastic nature of the materials.

GENERAL CHEMICAL RESISTANCE PROPERTIES

High impact styrene copolymers have excellent chemical resistance to non-oxidizing acids, alkalis, salts and mild oxidizing agents. However, they are not resistant to most organic solvents. The following charts illustrate graphically their resistance to many commonly encountered systems and can be used for qualitative screening. These charts are subject to the interpretations given in the earlier papers in this series.

On the charts that follow, the concentrations are actual concentrations. 100 percent concentration means 100 percent solid or 100 percent liquid as the case may be.

The Chemical Industry's best defense against corrosion



DURCO Type F Valves with Teflon®* sleeves

In the two years since DURCO Type F Valves were introduced to the Chemical Industry, several thousand have been put into operation and the list of successful applications continues to grow.

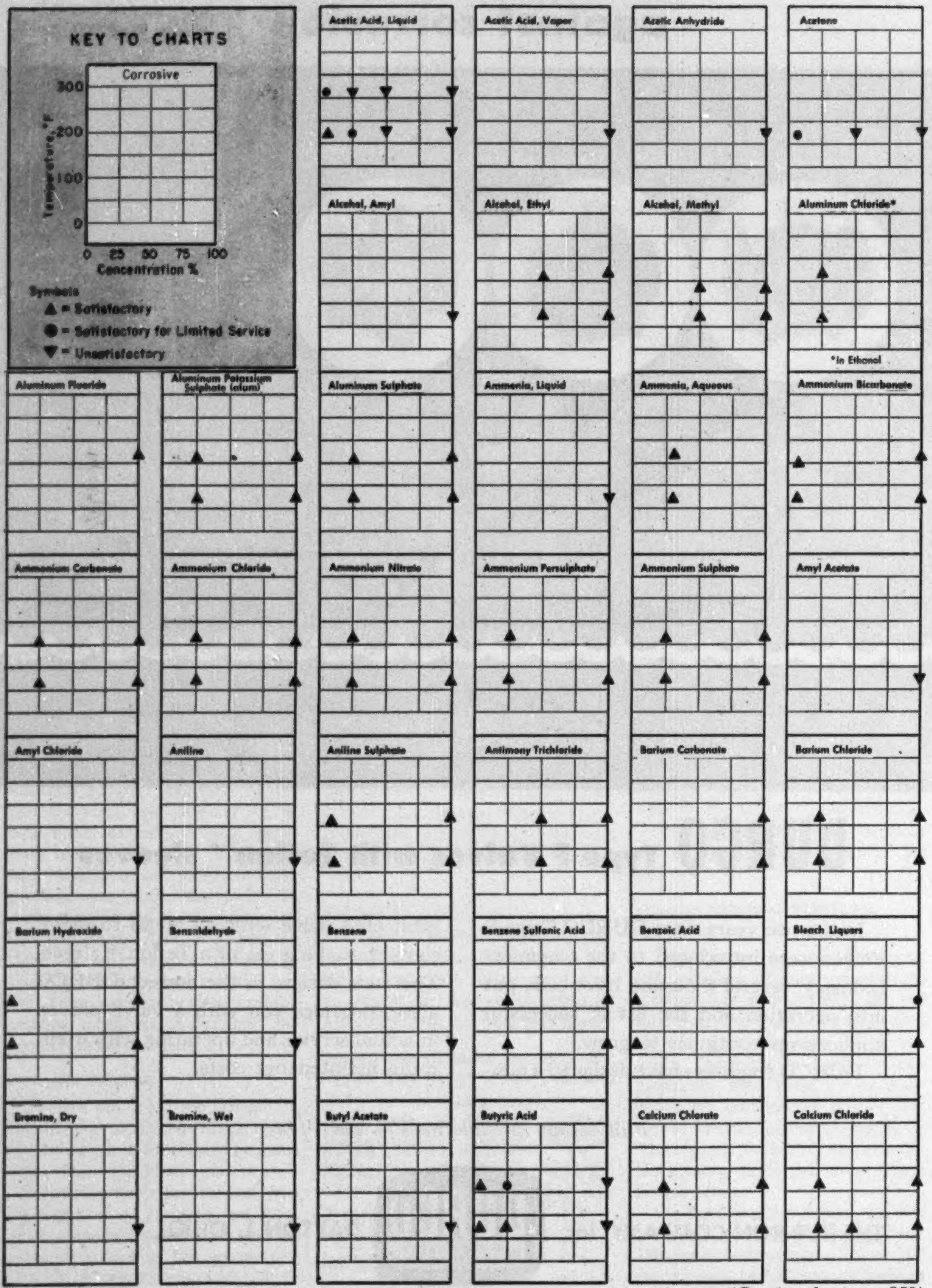
DURCO engineers have designed a non-lubricated valve with no metal-to-metal contact, making use of a Teflon®* sleeve. This new design, in the correct DURCO alloy, provides you with a valve proven in actual service and operating with minimum maintenance costs.

Full details in Bulletins V/4 and V/4a

THE DURIRON COMPANY, Inc. DURCO CORROSION RESISTING ALLOYS & EQUIPMENT **DAYTON 1, OHIO**

**Registered trademark of E. I. duPont de Nemours & Co., Inc., for its tetrafluoroethylene resin.*

Corrosion Resistance of High Impact Styrene Copolymers



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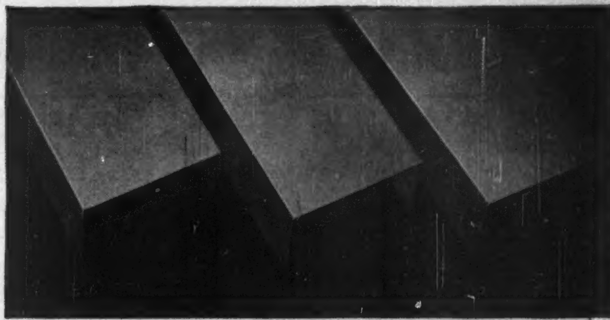


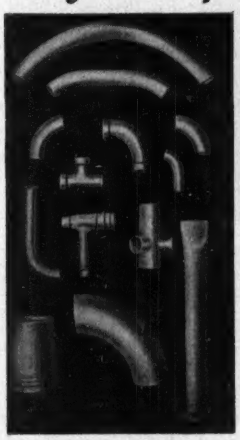
Rectangular Wave Guides made by TRENTWELD

1

2

Type 316 TRENTWELD Stainless Steel tubes are used in this Heat Exchanger fabricated by Kewanee-Ross Corp., Buffalo, N. Y.

any need for stainless or high alloy steel tubing is
better served with **TRENTWELD**



A baker's dozen of fittings made from TRENTWELD tubing

3

Name the need for special types, forms or finishes of stainless or high alloy steel tubing and the name to associate with it is TRENTWELD. For throughout all industry you'll find TRENTWELD meeting exacting requirements in these highly specialized fields. That applies to stock lines in food, paper and chemical plants. It is true of heat exchanger units in processing industries; and in cooling coils in breweries, the beverage industry, dairies and dairy equipment.

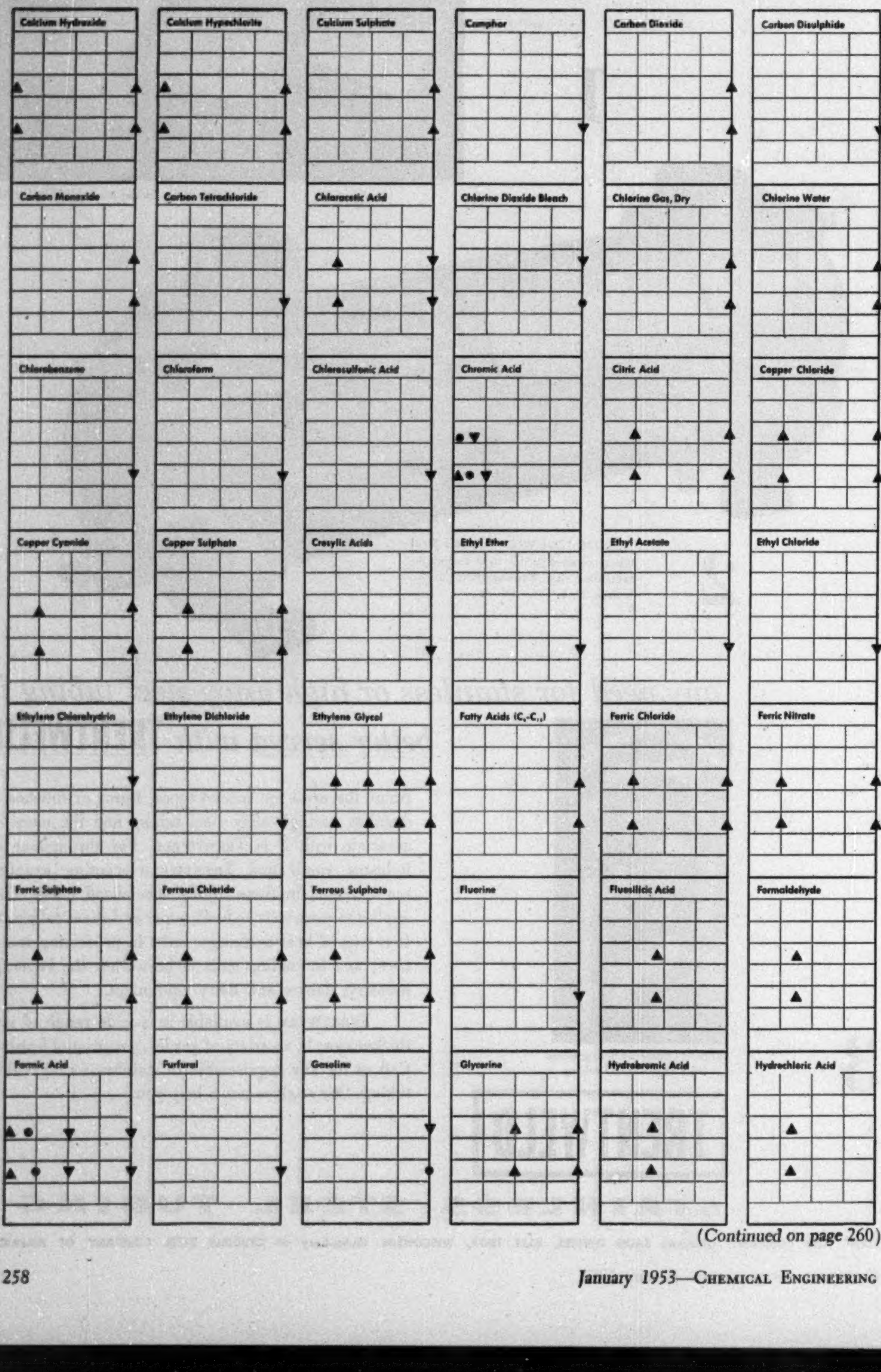
TRENTWELD is available in a wide range of wall thicknesses; in a variety of grades, gauges and finishes. Call us for any requirement in stainless or high alloy tubing. Our engineers can help you.

TRENTWELD

STAINLESS STEEL TUBING

TRENT TUBE COMPANY, GENERAL SALES OFFICES, EAST TROY, WISCONSIN (Subsidiary of CRUCIBLE STEEL COMPANY OF AMERICA)

Corrosion Resistance of High Impact Styrene Copolymers, *cont. . .*



(Continued on page 260)

For top belt-conveyor efficiency, top plant men rely on LINK-BELT

LINK-BELT engineering experience plus quality components combine to cut handling costs

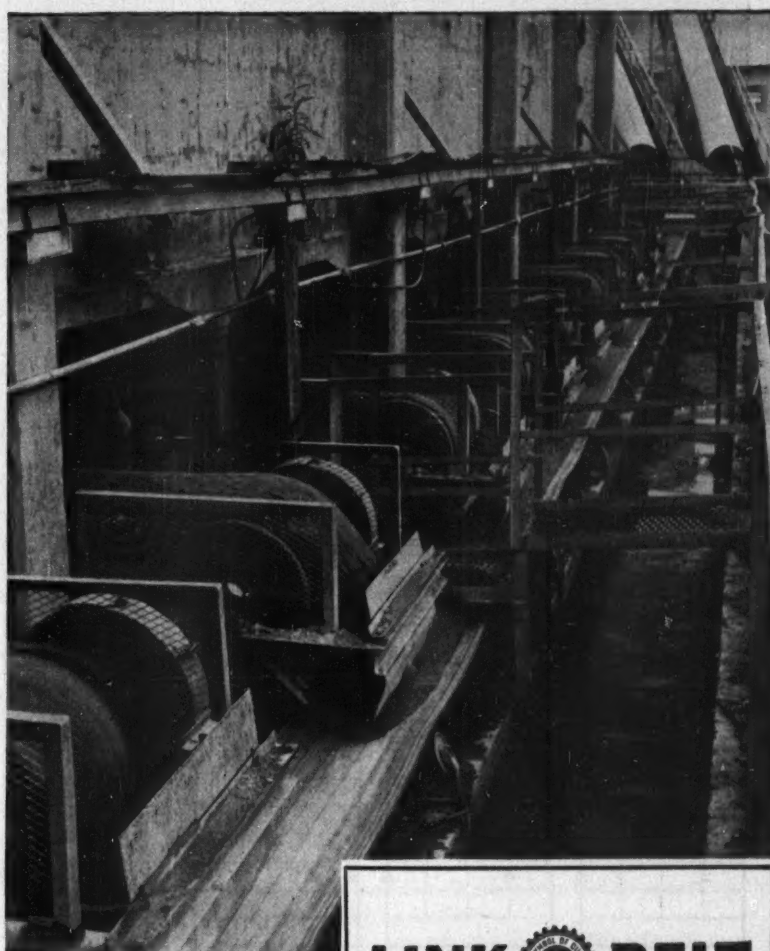
Yes, in plants everywhere, Link-Belt is first choice in belt conveyors. Whether your job is large or small, Link-Belt can apply unequalled engineering experience to meet the conditions of your particular system.

Link-Belt builds a complete line of quality components. Our conveyor engineers can choose from all types and sizes of idlers, trippers and terminal machinery to match your exact requirements.

Link-Belt can also supply all related equipment — other types of conveyors, feeders, elevators, car dumpers and shakers. And Link-Belt will build your supporting structures and enclosures . . . install the job completely if desired.

Link-Belt will gladly work with your engineers or consultants. Get in touch with your nearest Link-Belt office.

LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa), Sydney (Australia). Offices in Principal Cities. 12,747-D



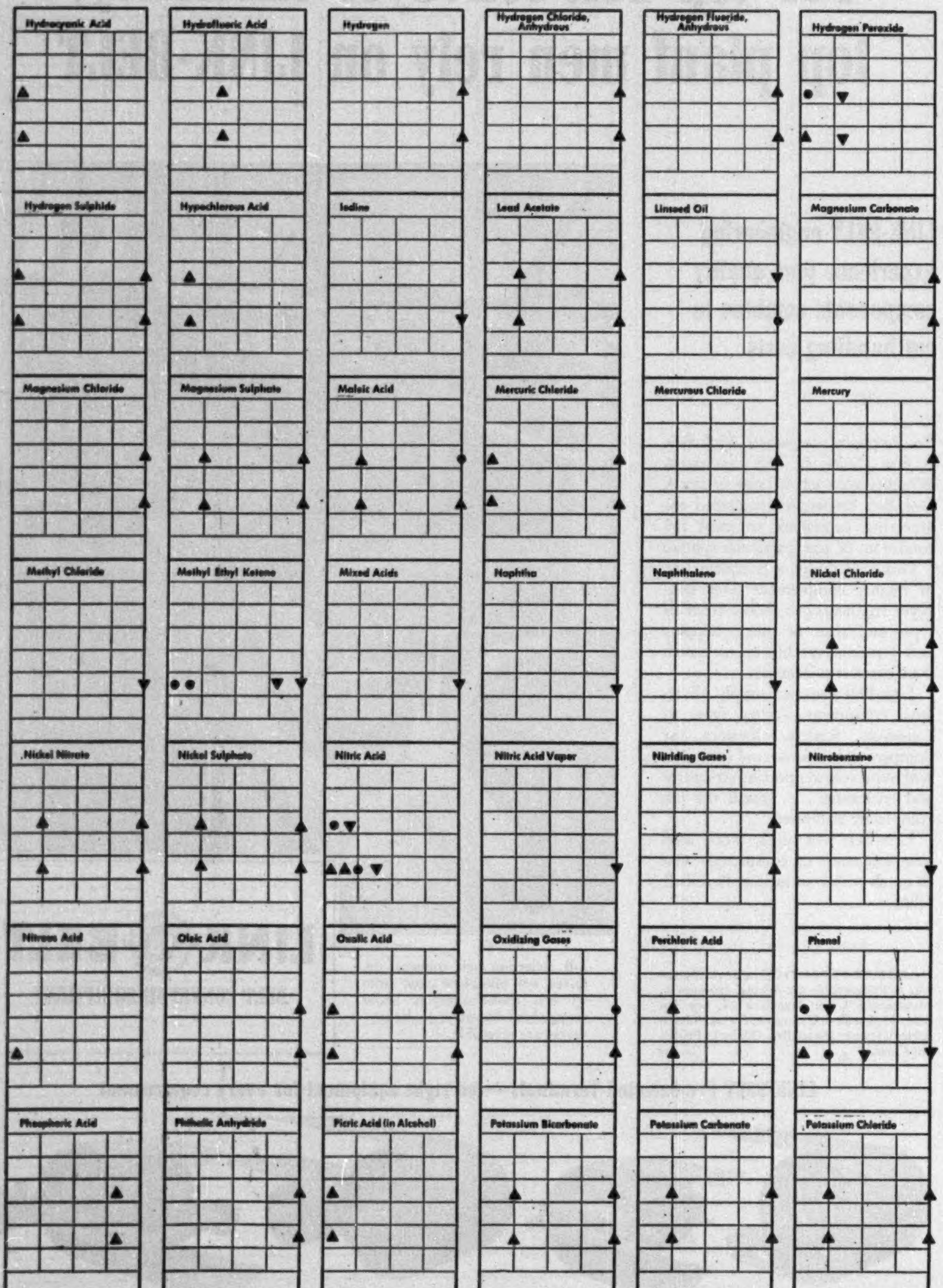
L-B collecting belt conveyor receives wet phosphate rock from 13 belt feeder-conveyors under storage bins. Eleven of feeder-conveyors are reversible.

LINK-BELT

BELT CONVEYOR EQUIPMENT

LINK-BELT Pre-Selected Terminals—the right equipment for every requirement

Corrosion Resistance of High Impact Styrene Copolymers, cont. . .



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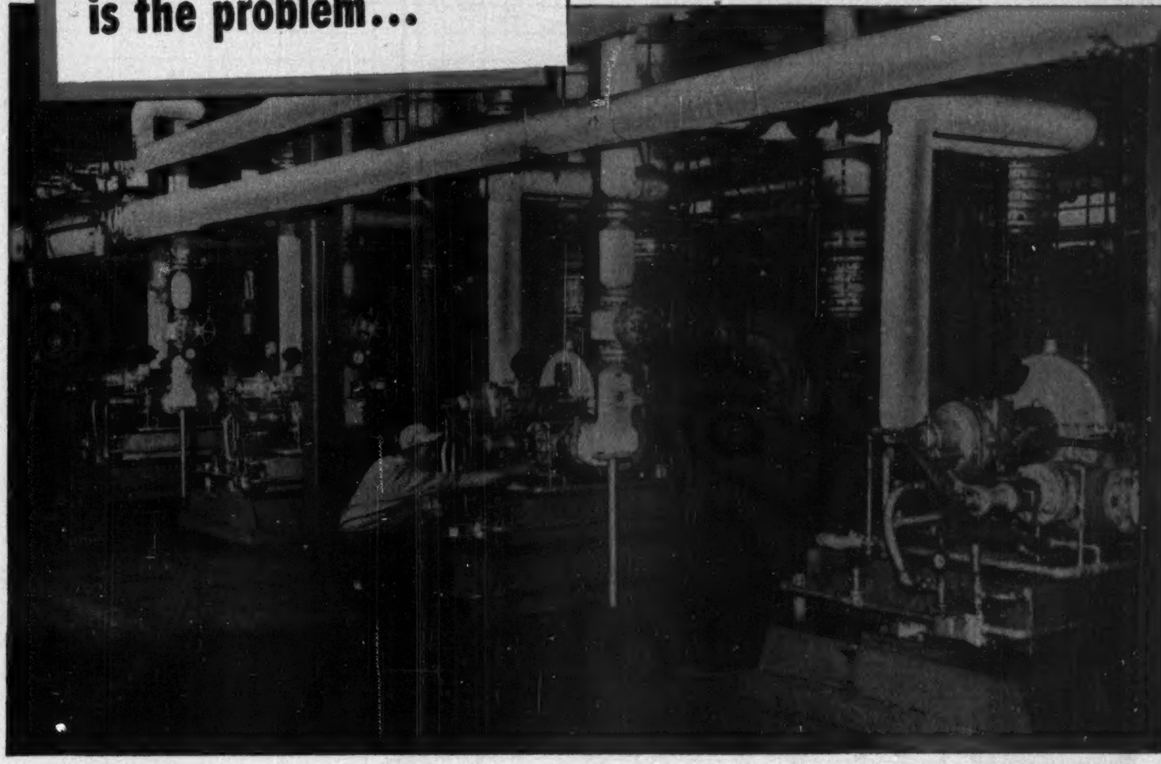
Where fluctuating load is the problem...



TYPE E gearturbines can handle it!

Process requirements in the evaporator room of the Masonite Plant, Ukiah, California, called for a variable-speed pump drive to provide for fluctuating load conditions. Steam was available. In the words of this user: "Westinghouse Type E, Close-coupled Gearturbines were selected since the pumps had to operate at relatively low speeds, and the higher efficiency inherent in the high-speed turbines was desirable. In operating performance, these turbines have proved the most efficient and economical solution to our problem."

Also in the evaporator room, the Masonite Company selected four Westinghouse Type E Turbines to drive the boiler feed pumps. These turbines provide an efficient, trouble-free drive which can be driven by the existing steam supply. Motor-driven units are used as stand-bys.

This use of both types of Westinghouse Turbines is the kind of over-all unit responsibility that actually makes your job of purchasing, installation, and maintenance easier . . . more dependable.

Wrapped up in a single package is a compact, rugged, and reliable speed-reduction unit solidly coupled to a Type E turbine. Each gearturbine is mounted on an extremely rugged base, fabricated of heavy steel plate which forms the oil reservoir. This arrangement simplifies mounting and installation. It provides operating stability never before available.

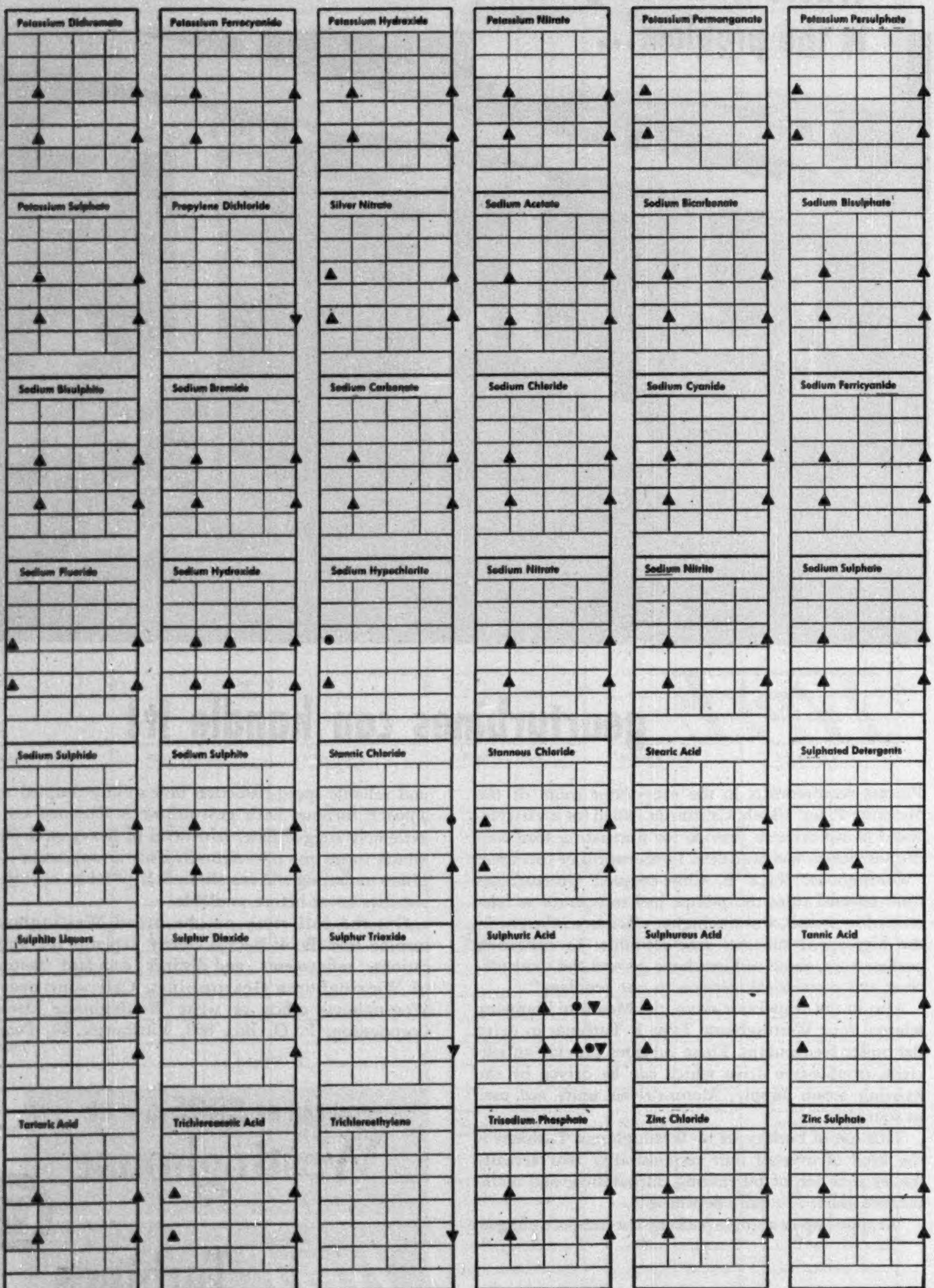
Get the full story on the broad Westinghouse turbine line. Book B-4346 clearly explains the applications, refinements and distinct standard features of Westinghouse Gearturbines. Call your nearby Westinghouse office, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

J-50539

YOU CAN BE SURE...IF IT'S Westinghouse

TYPE E Turbines

Corrosion Resistance of High Impact Styrene Copolymers, cont. . .

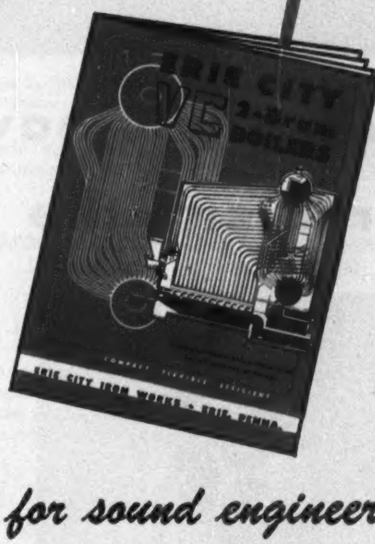


—*End*

the Erie City "VC"

A 2-DRUM Steam Generator with complete furnace cooling

A 50 year experience with 2-drum boilers is reflected in this modern design. Today's ERIE CITY "VC" incorporates scores of design, manufacturing and installation improvements. The Erie City "VC", as described in our latest catalog, offers high capacity in a compact design which saves space — lowers installation and maintenance costs and assures good operating characteristics with a wide choice of fuels and firing methods. New Catalog VC-3 describes the Erie City modern 2-drum Steam Generator in detail.



You can depend on Erie City for sound engineering

ERIE CITY
112 Years in Steam Generation

ERIE CITY IRON WORKS • *Erie, Pa.*

STEAM GENERATORS • SUPERHEATERS • ECONOMIZERS • AIR PREHEATERS
UNDERFEED AND SPREADER STOKERS • PULVERIZERS

Names in the News Edited by Frances Arne

Man of the month:

Philip H. Groggins

Retiring from his career as a government servant, he is often called the nation's top expert on agricultural chemicals.

Philip H. Groggins is leaving the U. S. Department of Agriculture (or more accurately NPA where he is "on loan"). He has been in government service for 26 years.

Groggins neither looks nor talks the way a government bureaucrat is supposed to. Perhaps that is the secret of his successful career.

Groggins refuses to be desk-bound. He was a track man in college and until recently he put in two miles or more every week at the Georgetown University track, just a few minutes from his Washington home.

Today he confines himself to playing bridge "when he isn't pushing the pen," he said. But his pen-pushing has been monumental as scores of technical papers and two books show.

Besides the book on aniline ("Aniline and Its Derivatives") which he wrote in the mid-twenties, Groggins is editor-in-chief of the well-known "Unit Processes In Organic Synthesis." The first edition of the book came out in 1935. Since then it has gone through five editions, and has been translated into Italian and Spanish. Over 40 percent of sales today are overseas. This book is a lifetime job in itself—for it generally takes two years of spare-time work to get it in shape each time a new edition is published.

Through his forthright dealings Groggins has earned the respect of all who have had the opportunity to work with him. Upon hearing that Groggins was about to retire, Lea S. Hitchner, executive secretary of the National Agricultural Chemical Association, wrote him:

"No one has made a greater contribution to our industry and the program of pest control than you have . . . today you are probably the best posted man on the entire industry in the whole country."

Groggins himself admits that he has been "fortunate" in his occupation. He says that government work is "challenging," and he makes a point of the fact that the U. S. is still relatively free. The opportunity for growth is here only. It isn't found in Communist countries.

"In the U. S. chemical engineers know that if they come up with a new process that can pay off in five years, the firms they work for will approve a change. But in England, there is no future for the chemical engineer. They want to preserve the status quo. In effect they want to share poverty, rather than progress. U. S. is unique in this incentive to progress," he said. "I see enormous opportunities in agricultural chemistry."

Although no longer with the government, Groggins' service will be on tap.

"I am planning to do a limited amount of consultant work in the years ahead and hope that in this way I'll be able to maintain the pleasant contacts I have had with the people in the chemical industry and government."

Groggins graduated from the College of The City of New York in 1912. He joined the staff of the Du Pont Company and was connected with that organization in various capacities at several plants until 1921. He then organized and managed the Veri-Best Chemicals, Inc. and initiated the commercial production of p-nitroaniline from p-nitroclorobenzene by ammonolysis. Veri-Best was absorbed by Tower Manufacturing Co. While with Tower he wrote his first book on aniline.

After a brief stay with Monsanto Chemical Co. Groggins in 1926 came with the government as a color chemist in the old color laboratory of the U. S. Department of Agriculture, then located at the site now covered by the Pentagon Building in Arlington, Va. During the next ten years he saw the consolidation of the American dye industry. This decade saw him obtain twenty patents covering several important intermediates. Since then he has obtained 40 more, for a total of 60 patents.

Groggins made the slow but sure progress of the technical man in government. By 1941 he was loaned as a top expert to World War II agencies, including the war food administration where he was responsible for chemicals needed for food production. In 1945 he returned to the USDA as technical advisor in the Bureau of Agricultural and Industrial Chemistry. The Korean situation resulted in a call for World War II experts.

Since June 1951 he has been chief of the agricultural chemicals section of NPA'S chemical division.

(Personals continued on page 268)

NAMES IN THE NEWS, *cont. . .*

Richard E. Lauterbach. Manager of the newly announced $35 million Pacific Northwest refinery to be built in Ferndale, Wash., by the General Petroleum Co. Has been assistant manager of the company's Torrance, Calif., refinery since 1950. Joined the company in 1936 as a laboratory assistant. Chemistry graduate of the University of California.

R. E. Lauterbach

Ernest O. Ohsol

Ernest O. Ohsol. Director of chemical engineering, Pittsburgh Coke & Chemical Co. Formerly at General Electric Co., Pittsfield, Mass., as manager, new product development laboratory. Before that, with Esso research center of Standard Oil Development Co. Graduate of MIT.

Robert H. R. Young. Assistant vice president in the manufacturing department of Crown Zellerbach Corp. Has been vice president of Pacific Mills Ltd.

G. L. Glespen. Returns as assistant manager of petroleum chemicals for American Cyanamid in New York city after a ten-month tour of duty with the PAD. Before leaving he was technical supervisor in the same department. At PAD he was chief of chemicals, containers and packaging branch.

Charles H. Prien. Head of the chemistry division, institute of industrial research at the University of Denver. On the institute staff since 1948, he will continue to serve as its administrator of international projects. Former member of the chemical engineering faculty at the University of Colorado. Doctorate from Purdue.

I. Perlman. Recipient of the annual award of the California section of ACS. Professor in the department of chemistry and radiation labora-

tory at the University of California. At Berkeley since 1945. Previously served on the Manhattan Project. Doctorate from the University of California.

H. E. Simmons. Winner of the 1952 Charles Goodyear Medal, highest honor in rubber chemistry. Dr. Simmons, now consultant to the Goodyear Tire & Rubber Co., is president emeritus of the University of Akron. Joined the university's faculty in 1910 as professor of chemistry and became president in 1933.

Gerald J. Leuck. Head of his own newly founded consulting firm which has been appointed special research consultant for Glyco Products Co. Has been technical director of Glyco at Natrium, W. Va. Previous employers: Corn Products Refining Co., Miner Laboratories, Quaker Oats Co.

Ernest H. Volwiler. Recipient of a testimonial plaque from the Chicago Drug and Chemical Assn. for his 34 years' service to chemistry and the drug industry. President and general manager of Abbott Laboratories, North Chicago.

Tom B. Nantz. Manager of B. F. Goodrich Chemical Co.'s new $5 million vinyl plastic monomer plant now in its final construction stages at Calvert City, Ky. His successor as plant manager at the company's Institute, W. Va., GR-S rubber plant: **Anton Vittone, Jr.,** formerly plant engineer. Nantz joined B. F. Goodrich laboratories as a chemist in 1937. Graduate of the University of Kentucky.

Robert S. Casey. Chairman of the ACS's division of chemical literature for 1953. Since 1943, director of research, W. A. Sheaffer Pen Co., Fort Madison, Iowa. Joined the company as a chemist in 1921. Studied at Trinity College, Hartford, Conn., and Columbia.

Lawrence Sullivan. New member of the research and development division of Wyandotte Chemicals Corp., Wyandotte, Mich. Graduate of Kent State University, Wooster, Ohio.

George W. Jandacek. Chemical engineer with the research and develop-

NAMES IN THE NEWS, *cont. . .*

ment department of Deep Rock Oil Corp., Tulsa, Okla. Graduate of Northwestern.

C. Y. Haas. Manager, technical division, Attapulgus Clay Co. Has been in charge of sales and technical service activities since joining the company in 1946. Previously with the technical service division of Esso Standard Oil Co. for five years. Chemical engineering graduate of Lehigh.

C. Y. Haas

George O. G. Lof

George O. G. Lof. Full-time consultant with offices in Denver to specialize in research planning, process design and plant economics. Has been chairman of the department of chemical engineering and director of the institute of industrial research at the University of Denver.

Norman Moore. Chemist in charge of the newly-opened technical sales laboratory in Cincinnati of Hilton-Davis Chemical Co. Has previously worked as a chemist with Perfection Paint and Color Co., Indianapolis; Frederick A. Stresen-Reuter Co., Chicago; Interchemical Corp. finishes division, New York and Cincinnati.

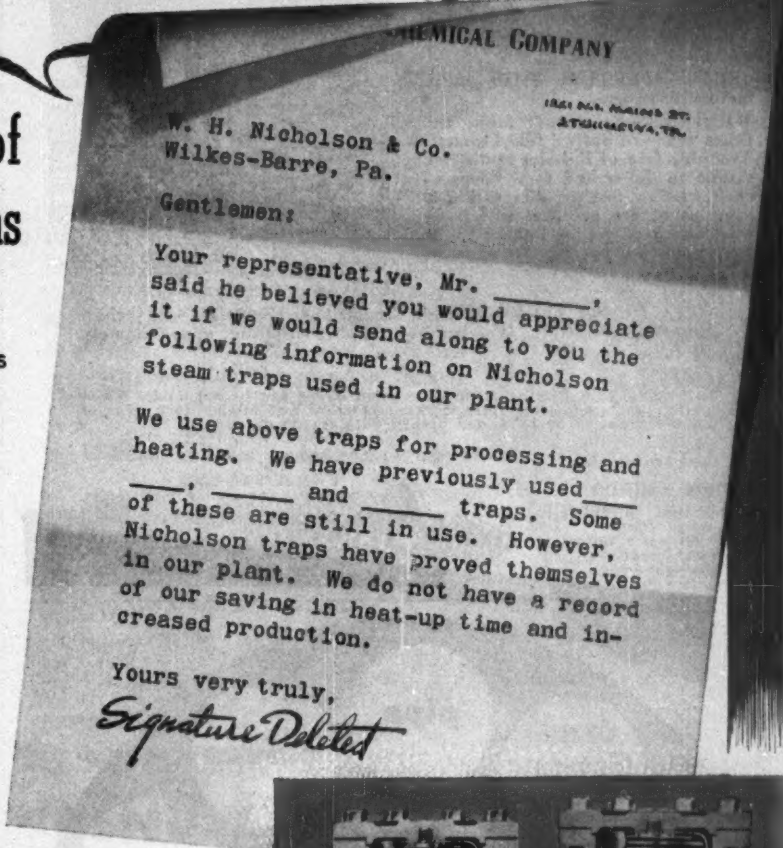
L. K. Fitzgerald. From director of research and development to coordinator of merchandising and manufacturing, Dan River Mills. His successor: **H. Y. Jennings** who formerly served as director of research.

Max Y. Seaton. Senior vice president and technical coordinator of the chemical divisions of Food Machinery and Chemical Corp. Has been executive vice president of Westvaco Chemical Div.

Tien-Shih Liu. Senior research associate in the metallurgy department, Horizons Inc., Cleveland. Formerly

"NICHOLSON TRAPS PROVE THEMSELVES"

..in plant of one of Big 6 chemical firms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Your representative, Mr. _______, said he believed you would appreciate it if we would send along to you the following information on Nicholson steam traps used in our plant.

We use above traps for processing and heating. We have previously used ____, _____ and _____ traps. Some of these are still in use. However, Nicholson traps have proved themselves in our plant. We do not have a record of our saving in heat-up time and increased production.

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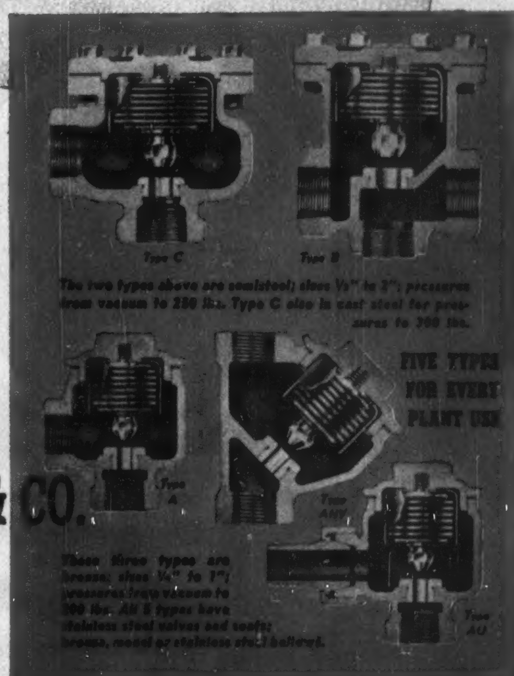
Signature Deleted

The importance of improving heat transfer efficiency in today's great processing plants increases as the proportion of critical applications grows and steam consumption mounts. The letter at the right is from one of the great chemical companies which have adopted Nicholson traps. Another of them recently reported that Nicholson traps were installed at one of their plants as part of a campaign to promote economical steam use. It resulted in a yearly saving of $500,000. See why an increasing number of leading plants are standardizing on Nicholsons.



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NAMES IN THE NEWS, *cont. . .*

in charge of the undergraduate metallographic laboratory at Notre Dame. New research supervisor in the department: **Virgil E. Straughan,** formerly with the Virginia Institute for Scientific Research. Department's new research supervisor: **Harry F. Ross,** formerly with Battelle Memorial Institute.

Melvin R. Arnold. With the research staff of Miner Laboratories, Chicago. Formerly with the Girdler Corp.

M. R. Arnold

John C. Warner

John C. Warner. Recipient of the Gold Medal of the American Institute of Chemists for 1953. President of Carnegie Institute of Technology. Joined the faculty as an instructor in chemistry in 1926. Has been successively assistant professor of chemistry, associate professor of theoretical chemistry, associate professor of metallurgical engineering, professor of chemistry and head of the department. In 1945, dean of graduate studies in the college of engineering and science; in 1947, assistant director of the college of engineering science. Doctorate from Indiana University.

Meyer L. Freedman. Head of the chemistry department, Horizons Inc., in Cleveland. With the company since 1951. Formerly with the Cleveland Graphite Bronze. New project supervisor in the department: **John M. Finn, Jr.,** formerly research assistant at the University of Pennsylvania.

Ross M. Hedrick. Group leader in Monsanto's central research department. With the company since 1947 as a research chemist. Doctorate from Indiana University.

J. Keith Lawson, Jr. Group leader, research and development department, Chemstrand Corp., Decatur,

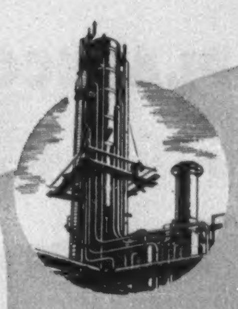
Ala. In the past he has been a research chemist for American Viscose, University of Illinois, Du Pont. Doctorate from the University of Minnesota. Other chemists newly assigned to the department: **William K. Easley, Ralph O. Fleming, Eugene L. Ringwald, Pompelio A. Ucci.** All were previously engaged in fiber research and development at Dayton and Marcus Hook where Chemstrand maintained laboratories until recently.

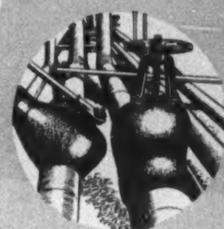

C. William Hardell R. R. Chambers

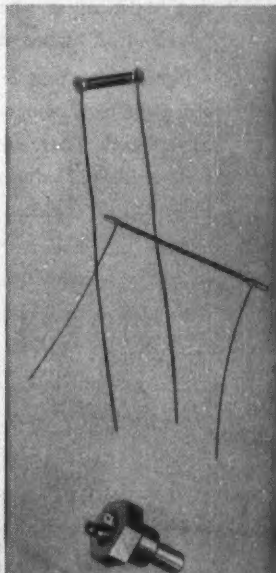
C. William Hardell. Vice president and manager of manufacturing, Sinclair Chemicals, Inc. Has been general superintendent, Sinclair Rubber, Inc. Was process superintendent for the company from 1942 to 1948, assistant superintendent of its refinery at Wellsville, N. Y., until 1950. Joined the company in 1934. Graduate of the University of Wisconsin. New director of research for Sinclair Chemicals: **Robert R. Chambers** who has been engaged in research work with the Sinclair organization since 1947. Studied at the universities of Nebraska and Illinois and at DePaul.

Allan T. Gwathmey. Winner of the 1952 Southern Chemist Award. Associate professor at the University of Virginia. On the faculty since 1938. Dr. Gwathmey is an authority on crystal chemistry. Doctorate from the University of Virginia.

Raymond H. Hartigan. Assistant director of research on the executive staff of Mellon Institute. Has been supervisor of the investigations at the various fellowships at the institute supported by Koppers Co. Joined the institute in 1941 as a fellow on one of the research programs sustained by Koppers. Instrumental in the development of the hydrogen cyanide, hydrogen sulphide recovery process now being employed by Koppers. From 1950







NAMES IN THE NEWS, *cont. . .*

to 1951, manager of the laboratory section of the Koppers research department.

Charles R. Milone

R. B. Stambaugh

Charles R. Milone. Superintendent of the atomic research laboratory, Goodyear Atomic Corp. Has been with Goodyear Tire & Rubber Co. since 1936 as research chemist, senior research chemist and then section head. New superintendent of Goodyear Atomic Corp.'s works laboratory: **Richard B. Stambaugh** who has been with Goodyear since 1934.

Everett G. McDonough. Recipient of the Medal Award for 1952 of the Society of Cosmetic Chemists. Vice president and general manager, Evans Research and Development Corp. Best known recent contribution to cosmetic chemistry has been the creation and development of cold waving of the hair.

Donald J. Haefele. Transferred to the patent department of Monsanto's organic chemicals division in St. Louis. Since 1947 a patent attorney at the company's central research department at Dayton. Previous employers: Goodyear Tire & Rubber Co., Pittsburgh Plate Glass Co. Studied chemistry at the University of Michigan and Case Institute of Technology and law at Cleveland Law School.

Dan M. Rugg. Vice chairman of the plastics committee of the Manufacturing Chemists' Assn. Vice president of Koppers Co., Pittsburgh. New member of the committee: **Harry M. Dent,** president of Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y.

Edward Orban. Chief of the research division's technical information section, Monsanto Chemical Co. Has been a group leader at the com-

hot liquids

corrosives

acids

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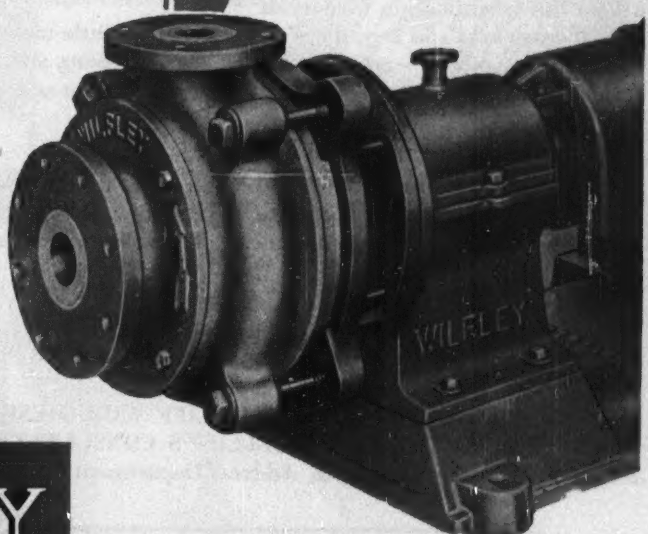
• For more efficient performance...greater economy of operation... specify WILFLEY "AF Acid Pumps. Dependable, trouble-free operation, on a round-the-clock schedule, with consequent stepped-up production and worthwhile power savings, are big reasons why modern chemical and processing plants all over the world now rely on WILFLEY Acid Pumps for handling acids, corrosives, hot liquids and mild abrasives.

• Available in 10- to 2,000-G.P.M. capacities, 15- to 150-ft. heads and higher. Wetted parts of practically all machineable alloys. Plastic lined models available. Every application individually engineered. Write or wire for details.



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pany's Mound Laboratory since 1948. Joined the company in 1946. Doctorate in chemistry from the University of Maryland.

John Geraci. Plant manager at Ossining, N. Y., for Gallowhur Chemical Co.

Lester D. Berger, Jr. Assistant product manager, fine chemicals division, Carbide and Carbon Chemicals Co., New York. For the past two years, assistant to the general manager of Carbide's atomic energy operations at Oak Ridge and at Paducah, Ky.

Bruce Jones. Developing research and planning activities for the refining and marketing division, Panhandle Oil Corp., Wichita Falls, Tex. Formerly chief project engineer of the fats and oils section of the Girdler Corp. with whom he had been since 1947. Before that, with the Texas Co. for about seven years. Chemical engineering graduate of the University of Texas.

Dwight Richards. Director of engineering, Oliver United Filters Inc., New York.

Benjamin F. Schlimme. From process manager to production manager of Du Pont's Grasselli Chemicals Department. Joined Du Pont in 1935 as a junior engineer in the engineering department. Transferred to Grasselli as a technical specialist in 1947. Chemical engineering graduate of the University of Pennsylvania; also studied at MIT. His successor as process manager: **Carl R. Faust,** engineering research manager of the Grasselli's technical division since 1950.

Desiree S. Le Beau. Chairman of the ACS's division of colloid chemistry in 1953, a post which she also held in 1949. Director of research of the Midwest Rubber Reclaiming Co., East St. Louis, Ill., since 1945. For the five previous years, research associate at MIT. Prior to that, research chemist for Dewey & Almy Chemical Co., Cambridge, Mass. Doctorate from the University of Graz in Austria.

Charles E. Bartley. Director of the propellant division, Grand Central

Aircraft Co., Pacoima, Calif. For many years chief of the solid propellant rockets section of the jet propulsion laboratory of California Institute of Technology, he is widely known for his work in the development of polysulphide rubber and plastisol base composite solid propellants now being used in numerous missile applications.

R. E. Bundy. Executive vice president, Fiberboard Products, Inc. His successor as vice president in charge of production: **M. E. Sanford,** formerly general sales manager.

Arthur F. Turman. Chief petroleum engineer, Standard Oil Co. of California's producing department in San Francisco. His successor as assistant chief petroleum engineer: **J. T. Crooker.**

Francis P. Squibb. From western manager to assistant general manager, pigment, chemical and color division, Sherwin-Williams. Has held his former post since 1936. MIT graduate.

Norman Moore. Chemist in charge of Hilton-Davis Co.'s newly opened technical sales laboratory.

T. Stephen Crawford and James H. Potter. Engineering educators who have joined Du Pont's engineering department for the second year of the company's "Year-In-Industry" program. Dr. Crawford is dean of engineering and director of the engineering experiment station at the University of Rhode Island. Dr. Potter is professor of mechanical engineering at the University of Illinois.

Donald Q. Kern. Has joined Manning & Lewis Engineering Co., Newark, N. J. Since 1948, director of the process engineering division of the Patterson Foundry & Machine Co., New York.

Odon S. Knight. Chief engineer, S. B. Penick & Co., New York. Formerly administrative assistant to the chief engineer, Commercial Solvents Corp.

R. L. Hock. Assistant manager of American Cyanamid's plant now under construction near New Orleans. Previously with U. S. Indus-

trial Chemical Co. for 28 years. Has been manager of the firm's plant in Baltimore from 1942 until this year. Chief engineer of Cyanamid's new plant: **V. E. Macdonnell** who joined the company in 1950. Previous employers: Spencer Chemical Co., Anaconda Copper Mining Co.

J. D. Patterson. President of the Assn. of American Feed Control. Chief chemist of the Oregon State department of agriculture.

G. W. Seymour. Coordinator of process and technical control, Celanese Corp. of America. He is a company vice president. New manager of the company's Summit, N. J., research laboratories: **B. B. Allen,** previously associate director of the laboratories.

Robert Bigham and **Jack R. Clemens.** Project engineers, T. A. B. Engineers, Inc., Chicago.

Robert K. Mueller. President, Shawinigan Resins Corp., an associated company of Monsanto. Mr. Mueller is general manager of Monsanto's plastic division at Springfield, Mass. New vice presidents of Shawinigan Resins: **W. Roy Elliot,** the firm's general manager; **Charles M. Schwab,** a vice president of Shawinigan Products Corp. Member of the board of directors of Shawinigan Resins: **Charles H. Sommer,** general manager of Monsanto's Merrimac Division.

R. B. Wainright. Technical director, petroleum chemicals department, American Cyanamid Co.

F. H. MacLaren. Research associate at Standard Oil (Indiana) Co.'s Whiting, Ind., research laboratory. He joined Standard Oil in 1925 as a research chemist; made group leader in 1941. Graduate of Ohio State. New group leader at the Whiting laboratory: **L. T. Crews** who joined the company in 1951.

Harvey R. Fifer. Vice president of Brea Chemicals, Inc., newly organized subsidiary of Union Oil Co. of California.

Larry Thompson. From head of the mixed fiber department of General

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Dyestuff Corp. to technical manager of the newly-formed cotton section.

Richard M. Hoover. From assistant supervisor in Monsanto's John F. Queeny plant to the raw materials section of the company's central purchasing department. With the company since 1947. Studied chemical engineering at the University of Kansas. **Henry V. Moss:** From associate director for the company's phosphate division at Anniston, Ala., to the St. Louis office of the division's research department. Continues as associate director.

Parker S. Dunn. Vice president in charge of production of American Potash & Chemical Corp. He will be in charge of production and engineering at the company's plant at Trona, Calif. Joined the company as assistant vice president in 1951. Previously with the Potash Company of America for ten years. Studied at Ohio State and MIT.

Herbert Fineberg. Director of research, Glyco Products Co. Has been chief chemist since 1948. Some previous positions: research chemist for Eastman Kodak; chief chemist for the Connecticut Hard Rubber Co. Doctorate from the University of Illinois.

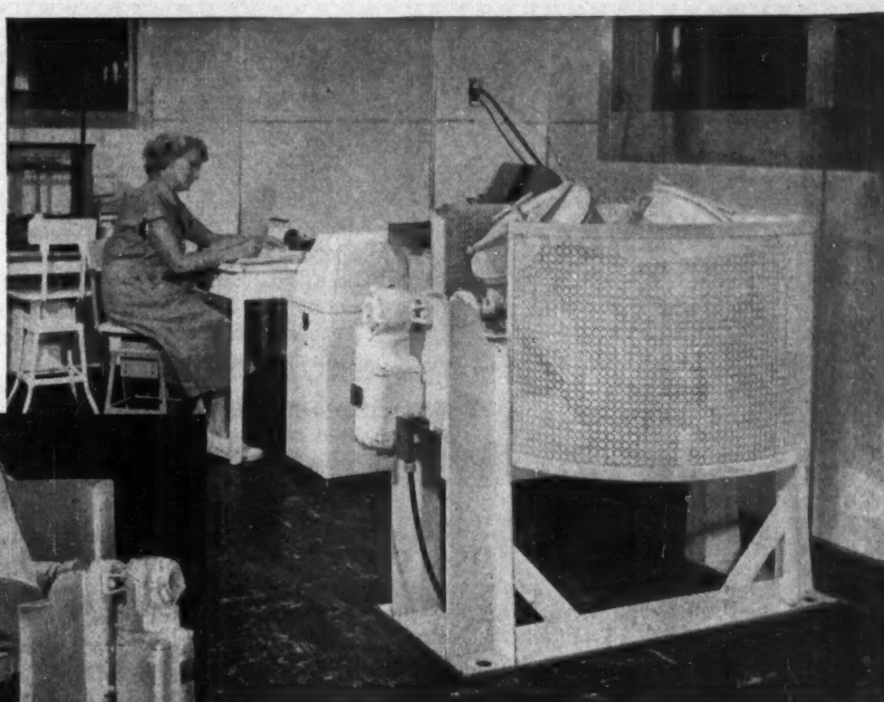
Ernest H. Wyche. New member of the staff of Kenneth Tator Associates, Coraopolis, Pa., consultants specializing in industrial maintenance problems. Formerly with the materials of engineering division of the Colgate-Palmolive-Peet Co.

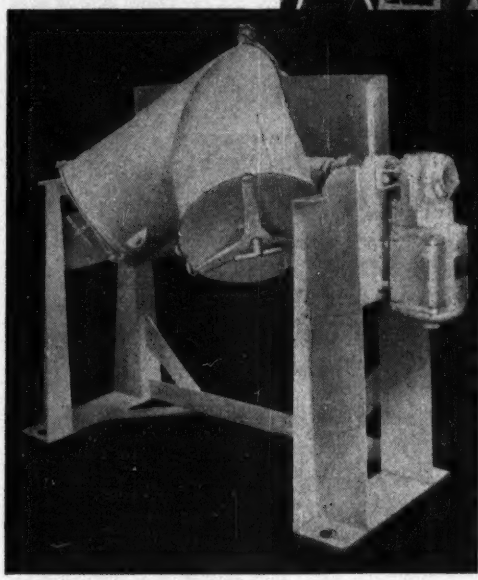
OBITUARIES

A. E. Lacomble, 58, retired chairman of the board and former president of Shell Development Co., died in San Francisco November 5.

Clarence M. Frazier, 48, vice president and director of the Food Machinery & Chemical Corp., died in San Jose, Calif., November 10.

Wilbur B. Dexter, 60, superintendent of the research laboratories of National Carbon Division, died in North Olmsted, Ohio, November 13.





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Simply designed for better blending.

SMITH, KLINE & FRENCH LABORATORIES, Philadelphia, Pennsylvania are now using **p-k** twin shell dry blenders to assure completely uniform blending of pharmaceuticals.

p-k twin shell blenders are outstanding for this work because blending is uniform and fast, and overblending is impossible — even where complete dispersion of minute quantities in a large mass is required. After blending, clinical cleaning is quick and easy.

p-k twin shell blenders assure thorough blending of all kinds of dry materials, including powders, grains, granules, pellets, chips or flakes— in any combination. Sizes range from 250 cu. ft. production blenders, down to pilot plant and 4- and 8-quart lab sizes. Sizes 3 cu. ft. and smaller are available with transparent plastic shells.

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Industrial Notes

NEW NAMES

Soft-Flex Glass Fabrics Corp., Puente, Calif., has changed its name to International Glass Fibers Co. Recently acquired by the International Glass Corp., the company will manufacture glass fibers in the form of bonded mat, battery separators and glass-fiber air filters.

Processing Oils and Chemicals Assn. has changed its name to the Textile Chemical Mfrs. Assn.

NEW LOCATIONS

Hood Chemical Co., manufacturers of products for household use—a bleach, a liquid starch and a liquid cleaner—has moved its headquarters to Ardmore, Pa.

Reliance Electric & Engineering Co., Cleveland, has moved its Newark, N. J., sales office to larger quarters at 535 High St.

Parke, Davis & Co. has moved its New York branch headquarters to the Empire State Bldg.

Spencer Chemical Co. will now handle its industrial chemical sales from an office at 38 South Dearborn, Chicago. The business was formerly handled from the company's Calumet City, Ill., plant.

J. L. K. Snyder, consultant on management problems, product development, distribution and sales promotion in chemical, pharmaceutical and nutrition fields, has moved his office to 220 East 42nd St., New York.

NEW COMPANIES

Dan Cu Chemical Co., Oklahoma City, Okla., to engage in chemical engineering and design for the petroleum industry and to act as analytical, consulting and manufacturing chemists.

Brea Chemicals, Inc., a subsidiary of Union Oil of California, to handle all development, manufacturing and sales of chemicals from petroleum. The company will be headed by Homer Reed. Temporary executive headquarters will be at Union's research center in Brea, Calif., and the sales office will be in Los Angeles.

Metco Corp., Dayton, Ohio, to develop and manufacture test equipment and related products.

Chiksan of Canada Ltd. to manufacture the products of the parent company, Chiksan Co., Brea, Calif., in Canada. A plant site has been bought in Brantford, Ont.

Hunter Associates Laboratory, Falls Church, Va., a testing and consulting group to be devoted exclusively to appearance and related optical properties of materials.

Vulcan Steel Container Co., Birmingham, Ala., to manufacture steel pails and steel shipping containers for paint, chemical, food and petroleum products. Hi-bake linings which meet the requirements of a wide diversity of food and chemical products will be produced.

Hubbellite Corp., Pittsburgh, Pa., to exclusively handle sales of Hubbellite, and inorganic copper-bearing floor surfacing cement made by the H. H. Robertson Co.

Hooker Chemicals Ltd., a Hooker Electrochemical Co. subsidiary, to manufacture chlorine and caustic soda for use in the pulp and paper mills of British Columbia. The company has just acquired a plant site in North Vancouver.

S. Schwartz & Associates, consulting engineers, New York, to specialize in the field of sulphur processing and recovery.

NEW LINES

Lee Rubber & Tire Corp.'s Republic Rubber Division—High-pressure industrial rubber hose called Republic Wiretex.

Narmco Resins and Coatings Co., Costa Mesa, Calif.—Metal-plastic adhesive for bonding Styrofoam to metal or other surfaces, through a

REYNOLDS METALS COMPANY

ANNOUNCES THE

FIRST COMPLETELY ORGANIC-FREE ALUMINUM TRIHYDRATE

This recently developed, sparkling white, premium grade of Aluminum Trihydrate will be offered in commercial quantities starting in February. Operation of new plant facilities for the production of this organic-free product is scheduled for January, 1953.

Reynolds scores another first in supplying the Chemical Industry with this brand-new product. Orangic-free Aluminum Trihydrate is naturally *snow-white* in color . . . purer than any other similar product now available. This new hydrate *does not* require treatment with oxidizing agents to render it acceptable for production of pure white end products.

NOTE: For further information call the Reynolds office listed under "Aluminum" in your classified telephone directory or write Reynolds Metals Company, 2567 South Third Street, Louisville 1, Kentucky.

Be sure to see "Mister Peepers" every Sunday night, 7:30 EST, NBC-TV; hear "Fibber McGee and Molly" every Tuesday night, 9:30 EST & PST, NBC.

REYNOLDS METALS

REYNOLDS CHEMICALS

FROM THE PRODUCERS OF REYNOLDS ALUMINUM

licensing arrangement with Northrop Aircraft.

United Saran Corp. Ltd., Rehovoth, Israel—Saran, a plastic developed by Dow. A license to manufacture was granted through Dow Chemical International Ltd.

Matheson Co., East Rutherford, N. J. —A line of reagent inorganic and organic chemicals formerly manufactured by Coleman & Bell Co. of Norwood, Ohio, which Matheson has recently acquired.

U. S. Industrial Chemicals Co.—Metallic sodium which it will sell for its parent company, National Distillers Products Corp.

Libbey-Owens-Ford Glass Co., Toledo —A complete line of reinforced fiber glass plastic panels through the acquisition of the Corrulux Corp., Houston.

NEW SERVICES

British Columbia Research Council will provide scientific assistance on technical problems for industry via a new division of technical services which is the result of a combination of the technical information service of the National Research Council with that operated by the British Columbia Council.

NEW REPRESENTATIVES

Lewis-Shepard Products Inc., Watertown, Mass., has appointed Mussens Canada Ltd. to represent its line of materials handling power trucks in Montreal, Que.

Clark Equipment Co. has appointed Hull Equipment Co. of Union, N. J., to handle its fork-lift trucks in the northern part of the state. Towne Industrial Equipment Co., Dallas, has been made Clark's authorized dealer in 129 Texas counties.

Norda Essential Oil & Chemical Co., New York, has appointed the A. W. Horton Co. as its representative in Mexico and the Philippines.

Parker Appliance Co., Cleveland, has appointed Nielsen Hydraulic Equip-

ment, Inc., New York, as an authorized distributor for its industrial tube fittings and tube working tools.

Process Industries Engineers, Inc., manufacturing and construction engineers of Pittsburgh, Pa., has appointed Bullock-Smith Associates, New York, as sales representatives in greater New York, northern New Jersey and Connecticut.

Reynolds Metals Co., Louisville, Ky., has appointed Barth Smelting Corp., Newark, N. J., as distributor of aluminum pig and alloy ingot products.

United Chromium, Inc., New York, has made S. A. Williams Co., Baltimore, a distributor of its Ucilon protective coatings in the Baltimore, Washington, Norfolk and Richmond areas.

Warren Steam Pump Co., Warren, Mass., manufacturers of a complete line of centrifugal, reciprocating and rotary pumps, has appointed J. F. Murray Co., Baltimore, as its representative on industrial sales for the Baltimore area.

U. S. Rubber Co. has appointed William E. Kingswell, Inc., Washington, D. C., as distributor of its radiant heat panels in Washington, D. C., northern Virginia and southern Maryland.

Baker-Raulang Co., Cleveland, has appointed Industry Services, Inc., New Orleans, as distributor for its industrial trucks in Delta states.

American Well Works, Aurora, Ill., engineers and manufacturers of pumps and sewage, industrial waste and water treatment equipment, has appointed A. Y. McDonald Mfg. Co., Minneapolis, as its representatives for Minnesota and F. S. Crook Co., St. Louis, Mo., to handle eastern Missouri and southern Illinois.

Reliance Electric & Engineering Co., Cleveland, has appointed Smithco Engineering, Tulsa, as its sales representatives in Oklahoma.

American Machine and Metals' De-Bothezat Fans Div., East Moline, Ill., has appointed Air, Dust and Fume Control Co., New York, as

INDUSTRIAL NOTES, *cont. . .*

its representative in greater New York and northern New Jersey.

C. O. Jelliff Mfg. Corp., Southport, Conn., has appointed J. J. Glenn & Co., Chicago, as its representative covering electrical resistance wire in the entire state of Illinois with the exception of Rock Island County.

NEW FACILITIES

Eastman Kodak Co., Rochester, N. Y. —New installation, a section of which is shown above, for production of mono-methyl-para-aminophenol sulphate, a developing agent. Some minor changes have been made in chemical processing techniques and production capacity has been increased.

Majac Engineering Co., manufacturer of a jet pulverizer,—New offices in Blawnox, Pa.

Beckman Instruments, Inc., South Pasadena, Calif.—A new building in Mountainside, N. J., to serve as its eastern sales and service offices and as an eastern manufacturing facility for its subsidiary, Helipot Corp.

Applied Research Laboratories, Glendale, Calif.—A branch factory at Lausanne, Switzerland, to supply spectrochemical equipment to European manufacturers.

Worthington Corp., Harrison, N. J.—A new division for sales, engineering and production of its Multi-V-Drives and all Speed Drives. Called the mechanical power transmission division, its headquarters will be in Oil City, Pa.

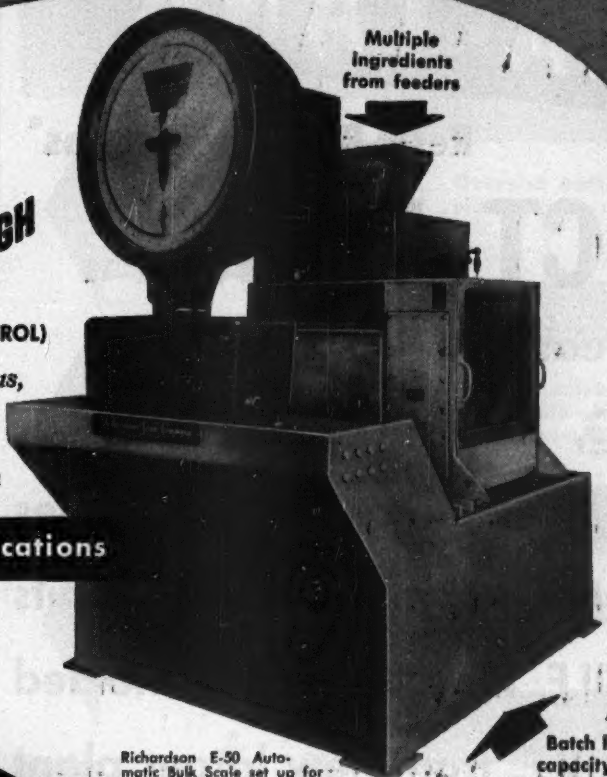
Commercial Solvents Corp., New York—An enlarged traffic department with headquarters in the New York office. The company's marine

SELECT-O-WEIGH

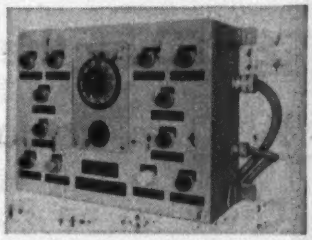
(ELECTRONIC WEIGHT CONTROL)

Remote, Instantaneous, Dial-Control Formula Changing and Ingredient Selection

For PROPORTIONING Applications



Richardson E-50 Automatic Bulk Scale set up for operation with the Select-O-Weigh. Discharge from E-50 would be through hopper to next operation on floor below.



Control panel for Select-O-Weigh handling constantly varying amounts of a single material. Weight desired is set on control dial, and compensation on smaller vernier knob below it. Multiple control dials for multiple ingredients.

Select-O-Weigh, Richardson's electronic weight control system, reduces the most complex formula-changing and ingredient-selection problem to push-button simplicity. For with Select-O-Weigh you select, measure, and deliver up to *twelve* ingredients from a single, pre-set, remote-automatic control panel.

Through incorporation of a simple, fool-proof electronic circuit, Select-O-Weigh changes formulas *instantly*, with the setting of a dial—no sliding poise adjustments or manual weight changing. And a single, automatic scale handles many ingredients—up to twelve or more.

Select-O-Weigh is designed for either cumulative or consecutive weighing, and can be used with many existing automatic scales.

The Richardson Scale Company, Clifton, N. J., will be glad to supply information on:

Feeder-Weigher Systems • Automatic Bulk Weighing Hopper Scales Automatic Bagging Scales • Bag Sewing Conveyors • Packers Process Control Panels and Select-O-Weigh

Please write direct to our Clifton office, or to the nearest of our branch offices, located in Atlanta, Boston, Detroit, Minneapolis, Cincinnati, Wichita, Montreal, Omaha, New York, Pittsburgh, San Francisco, Toronto, Buffalo, Chicago, Philadelphia, Houston.

Write for Select-O-Weigh Bulletin #0351.

Richardson

MATERIALS HANDLING BY WEIGHT SINCE 1902

8300

division will now be operated as a unit of the traffic department.

Monsanto Chemical Co., St. Louis—A new headquarters office building in St. Louis County to be completed within two years. It is part of an over-all plan to accommodate Monsanto's needs for many years. No manufacturing operations will be conducted at the county site.

John Powell & Co., New York—A plant in Atlanta, Ga., to make DDT, toxaphene and benzene hexachloride. The plant makes Powell the only firm in the Southeast specializing in basic insecticide materials for the independent manufacturer.

British American Oil Co. Ltd., Toronto—A multi-million dollar refinery in Moore Jaw, Sask. which incorporates the province's first fluid catalytic cracking unit. It will process about 15,000 bbl. of crude oil daily.

General Electric Co.—A $1.69 million service shop and warehouse in Philadelphia set up to handle all major transportation, utility and industrial apparatus.

Chase Bag Co., Chicago—A sales office in Richmond, Va., headed by J. A. White.

Gee-Bee Chemical Co., Los Angeles—A plant in Downey, Calif., to make products for servicing and solving the chemical cleaning problems of the aircraft industry.

Continental Can Co., New York—A plant in Omaha, Neb., to start production of metal containers during 1953.

St. Regis Paper Co.—A plant for its engineering and machine division to be ready for occupancy by the middle of next year.

Babcock & Wilcox Co.'s tubular products division—A district sales office in Syracuse headed by J. Y. McCandless.

Standard Oil Co. of Texas—A $10 million refinery expansion just completed at the company's plant at

El Paso. The new additions include a synthetic crude unit and a Houdriflow catalytic cracking unit each rated at 11,500 bbl. a day.

Allied Chemical & Dye Corp.'s nitrogen division–A $1 million expansion of its research and engineering facilities at Hopewell, Va. Completion is expected toward the end of 1953.

Monsanto Chemical Co.'s plastic division–A Cincinnati sales office which brings to six the total number of divisional sales offices the company operates this side of the Rocky Mountains.

Graver Tank & Mfg. Co., East Chicago, Ind.–A Pittsburgh district sales office with Robert E. Dunham as resident sales engineer.

Wilson Organic Chemical, Inc., Sayreville, N. J.–Expanded capacity to be completed early in 1953 for its soil conditioner, Poly-ack.

British American Oil Co. Ltd., Toronto–A $8 million addition to be built at the company's refinery at Clarkson, Ont.

Swedlow Plastics Co.–A new plant, its third, in Los Angeles to manufacture low and intermediate pressure laminates and to fabricate sheet plastics.

Black, Sivalls & Bryson, Inc., Kansas City, Mo.–A $2 million expansion of its plant for making equipment for the chemical, petrochemical, power, agricultural and air conditioning industries.

Reynolds Metals Co., Richmond, Va. –An aluminum reduction plant at Arkadelphia, Ark., to be completed in July 1953. It will have a yearly capacity of 110 million pounds.

Pittsburgh Coke & Chemical Co.–A plasticizer plant just opened at Neville Island, Pa., which will boost the company's plasticizer production to more than a million pounds a month.

Rezolin, Inc.–Greatly expanded Detroit facilities to meet the needs of the automobile industry for plastic dies for stamping truck cowl panels. Complete stocks, on-the-spot engi-

neering and consultation service will be available at the new location.

Humble Oil & Refining Co.—A unique solvent deasphalting plant at its Baytown, Tex., refinery which will have twice the capacity of any heretofore designed. Construction will begin early in 1953. The completed plant will charge 28,000 bbl. a day of vacuum reduced crude.

U. S. Rubber Co.'s Naugatuck Chemical Div.—Doubled production capacity at its Marvinol vinyl resin plant in Painesville, Ohio. The expansion program which is expected to be completed by June, 1953, will lift production to over 50 million pounds annually.

Monsanto Chemical Co., St. Louis—A phenol plant in Avon, Calif. Operation of the plant using a process recently developed by the company is expected by early 1954.

Mastic Tile Corp. of America—A \$500,000 production line for its Long Beach, Calif., plant which will increase output by over 90,000,000 sq. ft. a year.

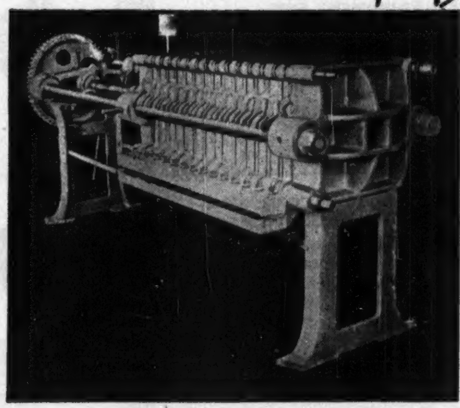
National Chlorophyll & Chemical Co.—A \$1 million chlorophyll extraction plant at Lamar, Col., with an annual capacity of over 100,000 lb. Ground has been broken for the plant, expected to be the largest of its type in the world.

Vitro Chemical Co.—Doubled capacity of its uranium ore reduction mill south of Salt Lake City. When the addition is completed daily production will come to about 350 tons.

Hewitt-Robins Inc.—A \$1 million addition to its conveyor belt plant in Buffalo, N. Y. The new facilities will increase the company's capacity for the belts by 41 percent.

Union Carbide & Carbon Corp.—Doubled capacity of its U. S. Vanadium Corp. division's uranium refining mill at Uravan, Col. Expansion of the mill involved construction of a number of thickening and solution tanks with 40,000 gal. capacity, new roasters, additional filtering equipment and enlargement of the sampling plant. —*End*

its a tradition



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Sperry has pioneered and developed the Filter press that today ranks as America's most widely used filter. This definite acceptance of Sperry engineering reflects the *tradition of quality* that for over a half century has set the standard for all Sperry equipment . . . as exemplified in these advantages of the Sperry Filter Press:

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Greater Performance: Produces maximum clarity . . . makes the driest cakes . . . can separate emulsions . . . delivers filtrate to higher level than filter . . . leak proof construction . . . can deliver cake in slab form . . . thoroughly washes the cake.

Greater Economy: Low first cost . . . low upkeep . . . low installation cost . . . low depreciation . . . long life.

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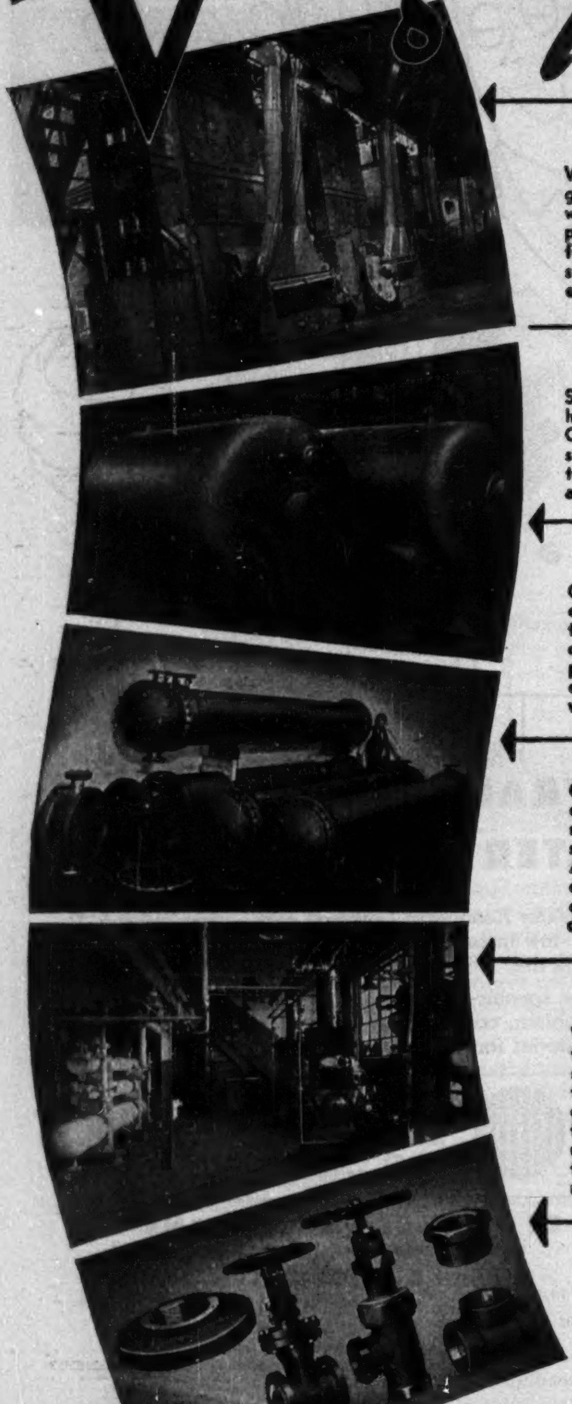

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Vogt steam generating units are designed to give maximum rating in a minimum of space with high efficiency and low maintenance expense. Bent tube types and straight tube, forged steel sectional header types to burn solid, liquid or gaseous fuels, as desired, meet every power, heating or process requirement.

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Stills, towers, oil chilling machines, filter presses, heat exchangers, etc. are constructed to all Codes. They meet all demands for operating security and trouble-free performance and help to lower costs in important process industries around the world.

SPECIAL MATERIALS FIGHT CORROSION AND PRODUCT CONTAMINATION

Our modern shops produce a wide variety of equipment made from special metals and alloys to combat corrosion, and product contamination or discoloration. Fabrication procedures employed insure that corrosion resistant properties of welds will match that of the materials from which units are constructed.

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Over 60 years of manufacturing experience, engineering and research stand behind Vogt refrigerating and ice making machinery. Absorption Systems, Compression Systems, and the Automatic Tube-Ice Machine in a wide range of capacities serve in leading petroleum refineries, chemical plants, ice and cold storage plants, dairies, packing plants, etc., at home and abroad.

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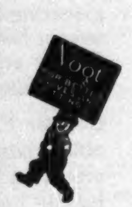
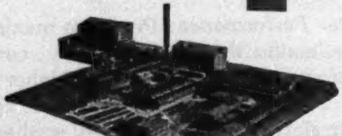
Vogt valves, fittings and flanges, for top performance in oil, water, air, gas, and ammonia services, at high or low pressures and temperatures, are available drop forged entirely from carbon steel or stainless steel. Valves can be furnished in a combination of materials by using stainless steel for parts affected by service temperature or corrosion, and less expensive alloys or carbon steel for other parts.





Air View of Vogt Plant

HENRY VOGT MACHINE CO.
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Centrifuge Chewing Gum?

. . . and one of the tougher problems that has been solved successfully by the Sharples Super Centrifuge.

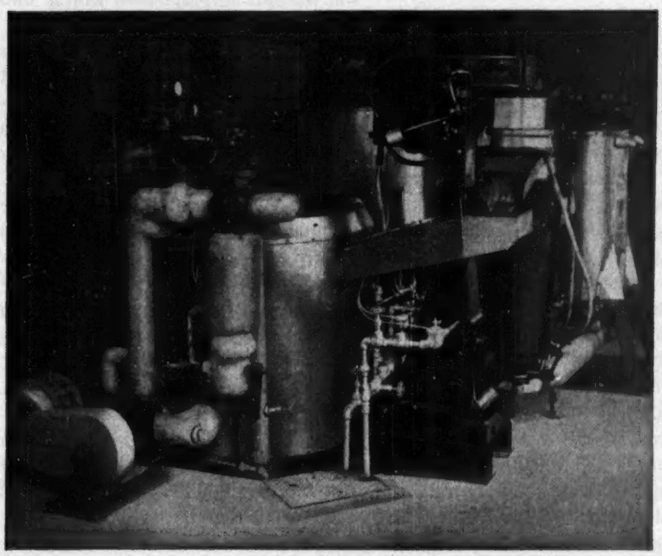
We mention the centrifugal clarification of molten chicle not only because of the highly viscous nature of chicle, and the cleanliness with which it must be processed—but for quite another reason:

A series of test runs made on a standard Sharples Super Centrifuge determined the design features necessary to handle this material that is difficult to transfer even through pipe lines. A new rotating element was engineered; new methods of introducing the chicle into this element were developed; radical changes in discharge covers were required; the frame was steam jacketed and special power requirements were detailed.

Solving the chicle problem represents the kind of centrifugal engineering for which the Sharples Corporation is well known and on which you can depend.

Added to the seven basic types of Sharples Centrifuges is the engineering ability and long experience of an organization skilled in the most effective application of one of these centrifuge types to your specific need.

Courtesy of American Chicle Company



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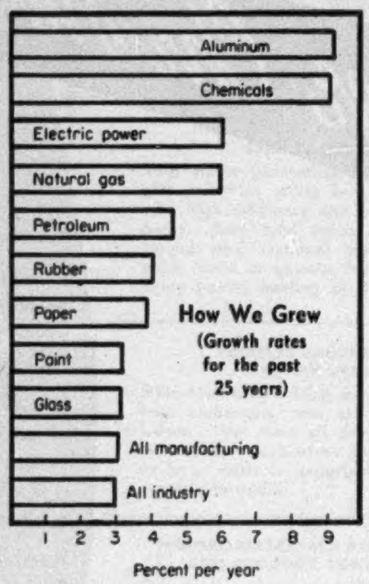
Who We Are

"The truth is that there are almost as many definitions of chemical industries as there are statisticians and chemical economists."

Where Are We Going?

"Chemistry is a creative science, and the first chapter of its Book of Genesis is yet to be written."



Short Report on the Industry

SIDNEY D. KIRKPATRICK

Because the layman comes in contact with so few chemical products as such, he has little idea what the chemical industries are. But confusion is not confined solely to the ranks of the layman. Even the most erudite often find it difficult to give a precise definition of the industries in which we earn our livelihood. The truth is that there are almost as many definitions of chemical industries as there are statisticians and chemical economists.

Who We Are

First off, let's face the fact that we are concerned with three distinctly different classifications or grouping of industries. It is important that we all understand these differences and are reasonably careful in our use of the corresponding terms.

1. Chemical Industries. (Sometimes referred to as "Chemical Manufacturing Industries.") This is the group we commonly call "Chemicals." It is made up of the U.S. Census classifications that include the manufacturers of general inorganic compounds such as mineral acids, alkalis, and salts; the general organic compounds, such as coal-tar products, dyes, synthetic organic chemicals, resins and plastics; compressed and liquefied gases, insecticides, fungicides, and agricultural chemicals, etc.

"Chemicals" is an industry, or rather group of industries, with products valued in the last (1947) U.S. Census at \$3,855,000,000. (Recently we estimated that their output in 1951 had reached \$5.2 billion.) This is the industry the public—including Wall Street—is most likely to call "Chemical." It is composed of such companies as Du Pont, Carbide, Allied Chemical & Dye, Dow, Monsanto, Hercules, Hooker, Mathieson, Diamond Alkali, and Penn Salt.

And, of course, it includes the chemical divisions of companies whose principal business is not chemicals, such as Eastman Kodak, General Electric, Shell Oil, B. F. Goodrich, U.S. Steel. In all, I estimate that there are perhaps 175 companies with sales over \$2-million per year that do 98 percent of the business in the "Chemical Industries."

2. Chemicals and Allied Products. This is the U.S. Census of Manufactures, Group 28. This classification dates back to the pioneering work of Charles E. Munroe, the great chemical economist who was responsible for reorganizing the 1901 census. It is therefore of historic importance and is often used, not too intelligently, I'm afraid, by the classical economists and the non-chemical statisticians.

It includes in addition to "Chemicals" (as defined above) such important industries as drugs and medicines, explosives, fertilizers, paints, pigments and varnishes, perfumery and cosmetics, rayon and allied fibres, salt and soap. Yet—and this is its principal fault—it fails to include as "allied industries" such basic fields as petroleum refining, rubber products, glass and ceramics, pulp and paper, and leather—to mention only a few.

From time to time the Census has added new products to Group 28, but in my opinion the classification is becoming of less and less value as a measure of chemicals industries. For our purpose today I think we can disregard it. Certainly, if we do use Group 28 and the term "Chemical and Allied Products" we must recognize its shortcomings. The 1947 Census reports a total of \$12 billion as the value of shipments of "Chemicals and Allied Products."

3. Chemical Process Industries. (Sometimes shortened to "Process Industries.") This is the more modern and comprehensive classification of the industries that process chemical raw materials by chemical engineering operations and equipment. This group embraces all of the industries noted above under (1) "Chemicals" and (2) "Chemical and Allied Products." But in addition it includes petroleum refining, rubber, pulp and paper, oils, fats and soaps, lime and cement, glass and ceramics, etc.

The Chemical Process Industries had an output valued in the 1947 census at \$35,937,222. Projecting those figures through 1951, we come to a total of \$53 billion, approxi-

S. D. KIRKPATRICK, *who is the editorial director of* Chemical Engineering, *spoke at the recent Engineering Centennial Convocation in Chicago on the status of the chemical industries today. This QED feature is a digest of his paper.*

QED, *cont.* . .

mately a fifth of all manufacturing industries in the United States, yet accounting for more than 40 percent of all capital expenditures for new plants and equipment.

Before we leave the Chemical Process Industries I want to show you our estimates for 1951 output. They are based on the McGraw-Hill Census of Manufacturing Plants completed in 1950. Later figures were estimated by our Department of Economics in cooperation with the market editors of *Chemical Engineering* and *Chemical Week*. The shipment value of "Chemicals" has increased from $3.855 million to $5.196 million. While the Chemical Process Industries as a whole has risen from $35,937 million to $53,000 million. Comparable gains are shown for costs of materials, fuel and energy, etc.

Size of Plants—The McGraw-Hill Census counted plants with over 20 employees. There were 8,302 of these in the CPI employing 2,066,843 people. But it is significant, I think, that 1,965,293 (or 96 percent) of these people worked in 5,478 or 66 percent of the plants, all of which had more than 50 employees, and that 1,815,841 (or about 88 percent) of these people worked in only 3,555 plants (43 percent of the total)—those with over 100 employees. In other words, most production is in the larger plants.

Plant Locations—The East North Central States (Ohio, Illinois, Michigan, Indiana and Wisconsin) have 22.63 percent of the plants and 27.25 percent of the employees. The Middle Atlantic (New York, New Jersey and Pennsylvania) are second with 26.91 percent of the plants, and 26.91 percent of the employees. South Atlantic had 10.62 percent of the workers, New England 9.60, West South Central 6.98, East South Central 6.46, and the three Pacific States, 6.43.

Where We Are Going

We are proud, I think, that "Chemicals" are in top place among the so-called growth industries today. A study made by the Stanford Research Institute shows that during the past 25 years the chemical industry has had an average growth of 9 percent per year, compared with 3 percent per year for all other industries.

Only two other divisions or subdi-

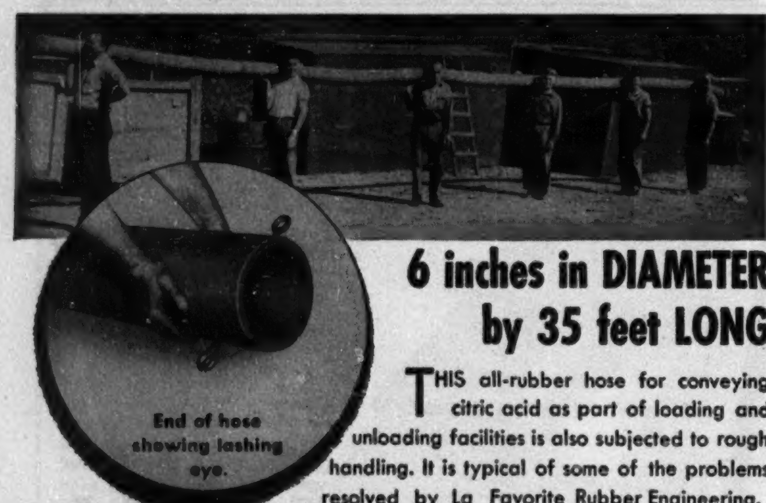
visions of other industries have had greater growth rates since 1929—air transportation up 30.3 percent per year, and aluminum 9.2 percent. Other growth rates that are of interest to us include the following: Electric power, 5.9 percent; natural gas, 5.8 percent; petroleum, 4.5 percent; rubber, 4.0 percent; paper, 3.8 percent; paint, 3.3 percent; glass, 3.2 percent; all manufacturing, 3.1 percent; all industry, 2.9 percent.

Writing in the Fiftieth Anniversary Issue of *Chemical Engineering*, Raymond H. Ewell, manager of SRI's Chemical Economics Service, predicts that Chemicals should surpass the textile and apparel industries in 25 years, and in 50 years should overtake all other groups except food and beverages. We know, of course, that research is the motivating force behind our dynamic growth. More and more natural materials are being replaced by man-made products. Manufacturing in more and more industries is dependent upon chemicals and chemical engineering processes.

Plastics vs. Fibers—Ewell also predicts that synthetic plastics will ultimately become the largest single subdivision of the chemical industry. In fact, he guesses it may become nearly half of the entire chemical industry during the next 50 years. Present production is probably in the neighborhood of a million tons, but there is room for much greater growth because plastics are steadily replacing competitive materials that in 1950 totaled 170 million tons.

Despite their recent expansion, synthetic fibers will ultimately fall into second place according to our Stanford chemico-economist. He believes their output will undoubtedly exceed that of the natural fibers during the next 20 to 25 years. But he holds that their ultimate market does not loom as large as that for synthetic plastics. (Of course, this is what makes horse racing so interesting, and it may ultimately call for further clarification and debate.)

Betting on the Future—Best proof of confidence in the future of the chemical process industries will be found in the billions of dollars that are being spent to back up this burgeoning program of growth, modernization and expansion. Last year our industries spent $4.6 billion for new plants and equipment. This was exclusive of $1.5 billion that went into the atomic energy program—



largely for chemical engineering operations.

In 1952 the total, again exclusive of AEC projects may well have reached $5.6 billion. Some tapering off, especially on defense projects, is to be expected during the next few years. But the capital-goods studies made by the McGraw-Hill Department of Economics in cooperation with the U.S. Securities and Exchange Commission and the U.S. Department of Commerce show that the chemical process industries may be expected to spend $4.8 billion in 1953, which is 46.7 percent of the total for all manufacturing industries.

In 1954, that proportion will increase to 48.5 percent, and in 1955 to 49.1. Thus, we see again reflected the more rapid growth of chemicals as compared with older industries.

Here's still another measure of our future: *Chemical Week's* index for the production of chemicals has been carefully projected on the basis of the increasing requirements of the chemical consuming industries during the decade 1951 to 1961. This shows a surprising gain of 75 percent for chemicals, while the chemical process industries as a whole increases by 30 percent. During this same decade total industrial production is expected to gain only 18 percent.

If that great and eloquent noble man of Chemical Industry, the late Arthur D. Little, were alive today, I think he might turn back to his Perkin Medal address of twenty years ago, just to say "I told you so" in these ringing words:

"Industries age like human beings. They have the hazards and diseases of childhood, the capacity for development in vigorous youth, the stability and strength of maturity and the conservatism and atrophy of age. The railroads are old, the automobile is approaching middle age, but our chemical industries are still in their energetic and elastic youth, with their greatest development still before them. . . . Chemistry is a creative science, and the first chapter of its Book of Genesis is yet to be written."

PROPHECY

. . . *Best Opportunities*

Top corporation executives, according to the *York Report*, select the

QED, cont. . .

following as the "ten greatest fields of opportunity for America after the defense program passes its peak."

1. Fuel from atomic energy.
2. Electronic brains.
3. Push-button factories.
4. The engineered home.
5. Television advances.
6. The small car.
7. New metal processes.
8. Advances in rare earths.
9. Antibiotics and farm chemicals.
10. Better plastics.

ADVICE

. . . *On Using Polystrenes*

High-impact polystyrenes have some desirable properties; they also have some limitations. In short, indiscriminant use of them doesn't pay off. Therefore guide yourself with these principles and you won't go wrong, says Charles J. Snyder, manager of the plastics development branch, Koppers Co., Inc.

1. Use high-impact styrenes for improved shock resistance in polystyrene type applications.
2. Use them for their acid and alkali resistance.
3. Use them for their good dimensional stability with shock resistance.
4. Use them for their good electrical characteristics with shock resistance.
5. Use them for their properties and not their low cost alone.
6. Do not expect the strength or durability of metals.
7. Look for guidance in a material suppliers data sheet.
8. Do not rely upon impact strength alone on proposed applications.

SURVEY

. . . *On Chemical Progress*

Because he is an impatient fellow, the chemical engineer is inclined to think that progress in his industry has not been fast enough. As a matter of fact, progress in engineering, according to Cole Coolidge, director of Du Pont's chemical department, has been fairly rapid in recent years.

To get a better perspective, he suggested at a recent talk at Earlham College a condensed time calendar. In this calendar 10,000 years would be

squeezed into one year, and 500,000 years into the life span of a man of fifty.

On this scale, man roamed the prehistoric world for 49 years before he settled down into organized communities. On the same scale, it was only 15 weeks ago that the Phoenicians introduced the alphabet. Du Pont came into existence as a manufacturer of chemicals only six days ago.

On the same basis, only two days have elapsed since the American chemical industry began organized research. And Du Pont, for instance, has conducted fundamental research for less than 24 condensed hours.

"Within the last day of our compressed calendar have come such discoveries as neoprene, nylon, color and sound in motion pictures, the release of atomic energy and the atomic bomb, jet planes, television and the antibiotic drugs."

PREDICTION

. . . *Greatest Challenge*

In the immediate future the greatest challenge for engineers in the plastics industry will be mechanical rather than chemical. According to Research Director Frank C. McGrew of Du Pont's Polychemicals Department, chemical engineering developments in the last 20 years in the plastics industry have been remarkable and gratifying. However, mechanical processing, which begins when polymerization ends, has not as yet been fully developed.

Speaking at the recent Centennial of Engineering in Chicago, McGrew suggests that it is time for an intensive and concerted fundamental approach to this problem by way of engineering research. "Since the key operation is the flow of material in a plastic state," he said, "one way of mobilizing this fundamental approach may be to start with rheology of viscous melts and establish the fundamental engineering basis for the propulsion, shaping and cooling of such materials."

REPORT

. . . *Ultrasonic Irradiation*

By speeding up reaction velocities, ultrasonic irradiation can mature wines and liquors in a few hours. Aging by natural means, writes E. A. Neppiras of Mullard Research Laboratory in

QED, *cont.* . . .

the British publication, *The Industrial Chemist,* generally takes many years. "It is necessary to add, however, that the process is not being used commercially, chiefly due to difficulties with the customs regulations."

ADVICE

. . On Stopping Accidents

A pipefitter was called into a production unit to replace a faulty gasket in a vapor line of a distillation unit. Since toxic materials were normally handled in this unit, care was taken at the unit to make sure all equipment was in order.

Everything went well as the pipefitter was tightening the bolts on a flange after putting in the new gasket. Then an operator in the production department opened a valve by mistake allowing a toxic mixture of gases to enter the unit under pressure and escape through the partially tightened flange. The pipefitter was killed by the gas.

Carelessness or faulty planning? According to Safety Director E. G. Volz, Monsanto, better control can be put into our safety programs if we want to put an end to accidents like this. Specifically, Volz recommends these control methods:

1. Evaluate plant-wide process hazards. That includes toxicity and explosive hazards.
2. Set up formal safety procedures for working in tanks or closed vessels and on roofs or elevated structures, for valve tagging and lock-out procedures. Also set up a fire permit procedure.
3. Instruct the workers in the correct use of personal protective equipment—self-contained breathing equipment, gas masks, respirators, goggles, gloves, safety shoes and so forth.
4. Set up programs of inspection and preventive maintenance, emphasizing good housekeeping.
5. Plan each specific job to make sure safety conditions and practices will prevail.
6. Develop general plant rules and regulations supplemented by specific department regulations, if they are required.
7. Get the support of all employees in the plant to cooperate with the plant safety program.

I ANALYSIS

1. **What's the purpose of the report?**
2. **What's its industrial role?**
3. **Who will be reading it?**

II INVESTIGATION

1. **What material will I need to get for the report?**
2. **Where can I get this material?**

III DESIGN

1. **What is the most practical way to organize my material?**
2. **How can I emphasize vital material?**

IV APPLICATION

1. **How can I best follow my plan?**
2. **What should I check for when I'm finished?**

Don't Write Reports

. . . engineer them, says a University of Washington professor. Why not approach report writing from an engineer's point of view, it's as good as any.

NOTE: *Professor James W. Souther believes too many engineers, as a result of improper instruction, approach technical writing as a traditional problem in English composition. This is not practical at all. A report has an industrial function, and it should serve it primarily. In the October issue of* The Trend, *a University of Washington publication, Souther described his engineering approach to report writing. The article is a basis for this QED feature.*—EDITOR.

In engineering design, good results will usually depend upon:

I. Analysis: How accurately and acutely you define the problem.

II. Investigation: How completely and thoroughly you study the problem-to-be.

III. Design: How finely and intelligently you plan the solution.

IV. Application: How carefully you act on the plan.

These same principles apply to report writing. Therefore, let's see how we can use them to help us write better reports.

I. ANALYSIS

To define the problem, you will want to: (1) determine the purpose of the report, (2) find the role it is to play in industry and (3) assay the audience to whom it is directed.

1. *Purpose.* What things should I include in my report? What things should I exclude?

If you can pin-point the reason for the report, you will probably have the answers. For example, a report directed toward a stricter observance of safety rules in a particular department will differ from one that reviews the actual observance of the present rules, and both of these will differ from one which aims at improvement and extension of the rules themselves.

The first stipulates clearly and concisely what is to be done in the future; therefore little mention of old practice is needed. The second includes a statement of past procedures, and records the observance of the rules. In the third, you would have to recommend modifications and additions to past rules.

2. *Industrial Role.* Will the report

QED, cont. . .

when completed be read for a short time then filed, or will it be referred to and read at odd times in the future?

If it is being written for the present, the reader probably will fit comfortably into the context of most experiments and findings. However, if it will be referred to in the future, you will have to consider the reader who will come upon the material cold.

3. *Audience.* A report writer should consider the education and experience of his readers. When he does this, he should know the amount of detail, the level of technical language and the explanation that would go into the report. But more important, he should know what is of most value to the reader—what the reader wants from the report.

II. Investigation

After this analysis, you will probably want to look into the problems that have cropped up. In this phase of preparation, it would be a good idea to: (1) decide what facts or data you'll need (2) gather data.

1. *Facts Needed.* If you know the purposes for writing the report and the audience for whom it is being written, you should have little difficulty here. However, you will have to evaluate this subject matter, and at this point you can go wrong.

As a result, you may fail to distinguish between the important and the related. Writers who make this mistake usually rush to cover all phases of the problem and end up writing an abortive text book. Such reports bury the important in a mass of irrelevance. But again, the mistake would not be made if the original problem was properly defined.

2. *Gathering Material.* Here an engineer is quite at home. However, although some fail to make use of all printed indexes and bibliographies, you shouldn't.

The scope and number of these research devices is amazing. Probably the best survey of industrial and engineering indexes will be found in the forthcoming McGraw-Hill publication, *Presenting Technical Ideas* by Vaughn and McClintock.

III. Design

Obviously there are many possible ways to organize any given material. Usually the report writer will ask, What is the best or ideal way to or-

ganize this material? By that, he usually means, What is the most natural or logical way to order these facts?

Such an approach of course is impractical. The report writers task is more difficult than this. He should ask himself, Which is the most useful way of organizing the material? In other words, the report must fulfill its purpose. Don't worry, if it has design then it will also have a logic of its own.

Naturally all this is easier said than done. The average report writer for example tends to arrange his material in the order in which he gathered it, and nine times out of ten this is not the most satisfactory organization.

Remember, to do its job well, a report should have emphasis. Besides an internal relationship, important material should be given fuller treatment than the less essential. Items of special value may be emphasized by placing them near the beginning of the report.

Successful report writers use such attention-getting devices as italics, capital letters, spacing, headings and subheadings. Also effective are such stylistic devices as repetition and parallel construction.

IV. Application

In this final phase, you will want to write up the report according to plan, check for effectiveness and prepare the final draft.

1. *Applying the Design.* Most successful report writers like to write clear through each section of the report. The concentrated effort gives a natural look to the phrasing, and it preserves the continuity of ideas.

As a suggestion, pay little attention to the mechanics of writing during the first draft. Grammar can be corrected later.

Also, whenever in doubt about including information, include it. It is much easier to cut a report than expand it.

Remember too, a writer should not feel that he is a slave to his plan. Although the design has been set, it should always be open to desirable modification.

Abstracts and summaries should be written last. After reading and outlining the report, you will have your finger on all essential information.

2. *Checking the Report.* Upon completion of the first draft, preferably after some time has elapsed, you should thoroughly check your report for organization, content, form and style. If possible you should have

QED, cont. . .

someone else look the report over.

Make certain the report is logical and clear. Each statement should look both backward and forward.

Data should be interpreted for the reader, because, contrary to the popular saying, facts do not speak for themselves. But most important of all, you should ask yourself whether or not the report leaves the reader with the desired point of view.

Check to see if all parts are clearly identified. All titles should be made clear by consistent use of headings, capitalization, location and spacing. Coordinate sections should have identical format, and subordination should be obvious by correct use of form. Finally, check the table of contents, index and abstract.

In matters of style, you should first check diction and grammar. Remove all deadwood, use the simplest words, and the most direct and concise phrasing you can think of. Last, be sure to check for mechanical errors in spelling and punctuation.

3. *Preparing the Final Copy.* Remember here to use standard materials and insist on neat and accurate copy.

Report Writing Check Sheet

Analysis

1. What specifically is requested?
2. What is the purpose of the report? The scope?
3. What industrial action is desired?
4. How will the report be used? By whom?

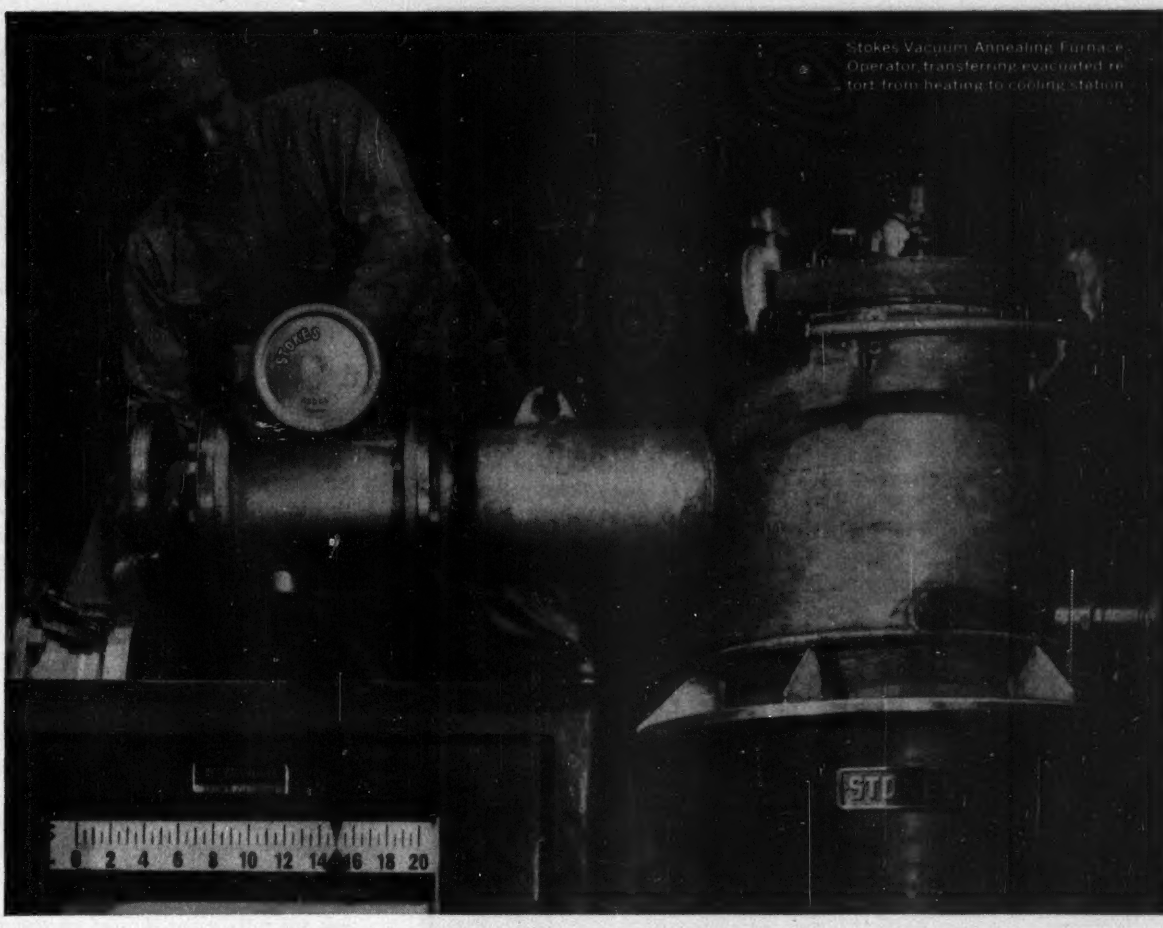
Investigation

1. What material is required?
2. What elements are of major importance?
3. What aid is available? Other reports? Articles? Persons?
4. What tentative plan should be followed?
5. Are the data accurate? Complete? Useful?
6. Do the conclusions actually grow out of the data and results?
7. What data, results, or conclusions are most important to the report's purpose? To its readers?

Designing

1. What organization will make the report best fulfill its purpose? Most useful and time-saving to the reader?
2. Does the nature of the report require emphasis on the data, the method, the results, the conclusions, the recommendations, or on a combination of any of these?
3. What level of technical usage and material can be understood by the reader?
4. What specific data, examples, details and illustrations are required for clarity of meaning?
5. Is a statement of authorization, purpose, scope required?
6. Does the complexity of the report or the use to be made of it require a table of contents, an index, an abstract?

(Continued)



Stokes Vacuum Annealing Furnace. Operator transferring evacuated retort from heating to cooling station

Make the step...from laboratory to production with Stokes High-Vacuum equipment

For processing titanium, zirconium, hafnium, and other metals... for low-cost melting, annealing and sintering of metals which must be processed under vacuum, Stokes makes the vacuum furnaces.

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We build to customers' requirements, with a sure knowledge of what *is* and what is *not* practical.

Stokes techniques of building vacuum processing equipment which *works* and *produces in bulk* at low cost have been developed during fifty years of experience with vacuum and high vacuum.

Visit the Stokes plant and see for yourself that Stokes is first in Vacuum... first in the manufacture of vacuum processing equipment which takes you over the gap between the laboratory and commercial production.

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STOKES

STOKES MAKES Plastics Molding Presses / Industrial Tabletting and Powder Metal Presses / Pharmaceutical Equipment / Vacuum Equipment / High Vacuum Pumps and Gages / Special Machinery

QED, cont . . .

Application

1. Is the organization sound?
   - A. Is the identity of the subject clear from the beginning? At all points?
   - B. Is the subject advanced by clear-cut stages? Are the relationships between the stages clear?
   - C. Does the conclusion of the report leave the reader with the desired point of view?
2. Is the content adequate?
   - A. Is it complete? Accurate? Clear?
   - B. Are more examples, details, facts, illustrations required for clarity?
   - C. Do the facts require more interpretation?
   - D. Are the major points emphasized?
3. Is the form functional?
   - A. Are all parts easily accessible?
   - B. Are the coordinate and subordinate relationships of the sections indicated by the form?
   - C. Are more organizational devices needed?
4. Is the style acceptable?
   - A. Is the exact meaning conveyed?
   - B. Are the sentences direct and effective?
   - C. Is there any deadwood to be removed?
   - D. Are the mechanics correct?
5. Have standard materials been used?
6. Is the copy neat and attractive?

REPORT

. . . Bricks and Tiles And Concrete Piles

Into the new Ethyl TEL plant at Houston, Tex., the Ethyl News reports, went these materials . . .

15,500 tons of steel
46,000 cu. yd. of concrete
500,000 bricks and tiles
200 miles of pipe
275 pumps
20,463 valves
625 miles of electrical wiring
5,000 lightning fixtures
26,000 gal. of paint
4 miles of roads and streets
6.25 miles of railroad track

OPINION

. . . Atomic Problems

If atomic power were to become a commercial reality tomorrow, what would be the chief problems of the chemist and chemical engineer who had to work with it?

According to AEC's Eugene M. Zuckert, the principal technical problems for them would probably be:

1. Disposal of radioactive wastes economically and without hazard to environment.

2. Concentration of waste fission products.

3. Economic separation and packaging of fission products.

4. Separation of isotopes by chemical means.

5. Understanding the effects of radiation on living cells. The gross biological effects are well known; however, the chemical reactions responsible for these effects are as yet largely unexplained.

6. Working with high degrees of refinement in handling atomic matter. The chemist and chemical engineer will have to worry about parts per million and occasionally parts per billion.

SURVEY

. . . *Chemical Packaging*

New chemical products, new engineering techniques of manufacturing, and new fittings and linings are responsible for the changes in chemical packaging in the last seven years, says Donald K. Ballman, general sales manager of Dow, who spoke at the recent national meeting of the AIChE in Chicago.

Specifically, standard cylinders and carboy bottles have been improved; fiber drums, multiwall paper sacks, aerosol bombs and small barrels are seeing increased service; and a new ethylene oxide drum, along with new types of polyethylene containers, has been developed.

Cylinders, Ballman says, have shown no basic changes. But the development of high strength alloys of lighter weight have made possible a more economical container. Since their development, the unfavorable ratio between cylinder weight and weight of the product has been cut. Versatility of the metal drum has also been increased by the use of such metals as stainless steel of various types, nickel and monel.

Smaller containers like carboy bottles have been made more safe. To vent pressures, special plastic closures have been adapted to 6.5-gal. machine-blown carboy bottles that carry high purity reagent acids. The closure, a polystyrene cap with a special polyethylene liner, is designed to vent pressures exceeding 10 psi.

The phenomenal increase in the popularity of the fiber drum, Ballman believes, stems directly from its general excellence. It is strong, light, easily filled, sealed and opened; is easily marked by any of the standard methods and is easily disposed of when no longer useful. However, he explains, the diversion of steel to military uses during the last war gave im-

QED, *cont.* . .

petus to the widespread use today.

Actually the beer trade is responsible for the increased use today of small aluminum and stainless steel barrels in the chemical industry. The barrels, which were originally developed to carry beer, are replacing to some extent, carboys and glass containers, particularly in handling fine chemicals. They are convenient to handle, stack well, drain completely and do away with the special packing and handling given to glass containers.

During and since the war, the multiwall paper shipping sack has seen an outstanding growth, says Ballman. It is, he explains, relatively low in cost, ships and stores economically when empty; can be filled and handled rapidly and cheaply, and can be obtained in almost any degree of strength. Besides economy, wet-strength kraft paper and various types of plastic and foil liners provide weather resistance and a high degree of protection to the contents of the sack.

Like the beer barrel, the modern aerosol applicator bomb is an adapted packaging item. Although originally developed for applying insecticides, the aerosol container is now widely used for all sorts of things, says Ballman, that can conveniently be dispersed or applied by pressure. Of course, he says, the polyethylene plastic pinch bottle is merely the simplification of this container—the pressure supplied manually instead of by a compressed gas.

Polyethylene is also being used to make a carboy type package. The new plasic bottle is strong, Ballman says, not subject to breakage by impact and can be safely and simply packed in a cylindrical fiber or plywood drum. It is also lighter than the conventional glass carboy. Before long, it should prove to be a useful package for a number of new products.

A new type drum has been developed primarily for hauling ethylene oxide. Oddly constructed, it is an insulated drum—actually a drum within a drum—with valves to facilitate recovery of the product. The insulation keeps the inner drum, holding the low boiling ethylene oxide, cool while fusible safety plugs in the drum head let off internal pressure. There is little danger of rupture should decomposition occur. This new drum is now covered by ICC Specification 5P.

are these alkyl phosphites your blessed event?

DIALKYL and **TRIALKYL** PHOSPHITES are new arrivals in the chemical world... so new that their full possibilities have not yet been developed. Perhaps their birth may represent a "blessed event" in your particular field. It will pay you to examine the interesting properties of these new organic compounds.

Laboratory tests indicate these and many other use opportunities:

...As intermediates in the synthesis of other organic phosphorus compounds.

...As additives to lubricating oils, to serve as corrosion inhibitors, stabilizers, and antioxidants.

...In extreme pressure lubricants, to improve such factors as viscosity, film strength, load carrying capacity, penetrability, and to retard wearing, scuffing and seizing of bearing surfaces.

...As stabilizers, plasticizers, and antistatic agents.

All of the Alkyl Phosphites listed in the table below are available in commercial quantities. Samples and technical literature are yours for the asking. Simply request these on your company letterhead.

VC CHEMICALS®

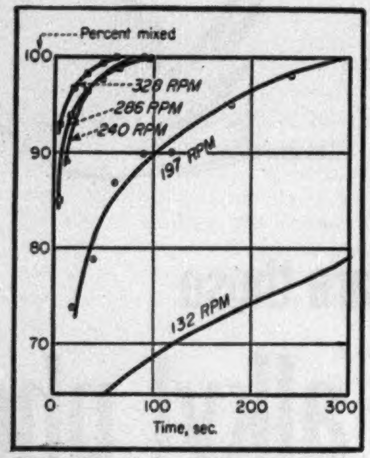
DIALKYL HYDROGEN PHOSPHITES	Boiling Point	Specific Gravity	Flash Point, Cleveland Open Cup	Solubility in Water
DIMETHYL	72-3°C/25 mm	1.200	205°F	Soluble. Hydrolyzes.
DIETHYL	65-6°C/6 mm	1.079	195°F	Soluble. Hydrolyzes.
DIBUTYL	118-9°C/7 mm	0.995	250°F	Slightly soluble. Slowly hydrolyzes.
DI-2-ETHYLHEXYL	163-4°C/3 mm	0.937	330°F	Insoluble. Very slowly hydrolyzes.
	All possess good thermal stability. Miscible with alcohol, ether, and most of the common organic solvents.			
TRIALKYL PHOSPHITES				
TRIETHYL	65-6°C/24 mm	0.969	130°F	Slightly soluble. Hydrolyzes.
TRI-2-PROPYL	94-6°C/50 mm	0.914	165°F	Insoluble. Slowly hydrolyzes.
TRIBUTYL	118-21°C/7 mm	0.925	250°F	Insoluble. Slowly hydrolyzes.
TRIHEXYL	135-41°C/0-2 mm	0.897	320°F	Insoluble. Very slowly hydrolyzes.
TRI-ISO-OCTYL	161-4°C/0-3 mm	0.891	385°F	"
TRI-2-ETHYLHEXYL	163-4°C/0-3 mm	0.902	365°F	"
	All possess good thermal stability. Miscible with alcohols, benzene, ether, heptane, carbon tetrachloride, and most of the common organic solvents.			

Elemental Phosphorus
Phosphoric Acids
Trisodium Phosphate
Disodium Phosphate-Anhydrous
Tetrasodium Pyrophosphate
Sodium Tripolyphosphate
Ferrophosphorus
Sodium Metasilicate
Tetraethyl Pyrophosphate
Alkyl Phosphites
Other Organic Compounds of Phosphorus

VIRGINIA-CAROLINA CHEMICAL CORPORATION

***Chemicals Division:* 401 East Main Street, Richmond 8, Virginia**

QED, *cont. . .*



BEST: Two-blade paddle stirrer

REPORT

. . . *Most Efficient Stirrer*

Over a speed range of 130 to 330 rpm. in a liquid-liquid system, the two-blade paddle is probably the most efficient stirrer made, recent investigators report. The large Hoesch stirrer and the four-blade paddle are next best.

Besides this conclusion, Researchers R. E. Wingard, Margaret N. Vinyard and Claude M. Craine, Jr., recorded the following results of their studies in Engineering Bulletin No. 17 of Alabama Polytechnic Institute:

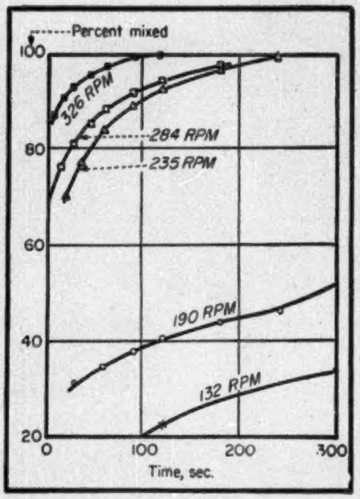
1. Hoesch type stirrers give far the most intimate mixing. The forty-five degree paddle and the twenty-two and one-half degree propeller cause vortexing at the higher speeds used during the tests.

2. The size of the Hoesch stirrer determines mixing efficiency. The small Hoesch gives a low rate of mixing, while the large one gives a high rate. However, above the range of speeds tested, the large Hoesch is even more efficient.

3. The four-blade paddle, which is inefficient at low speeds, becomes more efficient as stirring speeds increase. It reaches maximum efficiency after turbulent flow is attained.

4. Of all the stirrer types tested, the small Hoesch shows the lowest power consumption. Following in order are: propeller, large Hoesch, forty-five degree paddle, two-blade paddle and the four-blade paddle.

5. All stirrers show a higher percentage-mixed when four baffles rather than two or no baffles are used. Al-



NEXT BEST: Large Hoesch stirrer.

though power consumption is higher, stirrers are more efficient with four baffles. In the runs plotted above, four baffles were used.

OPINION

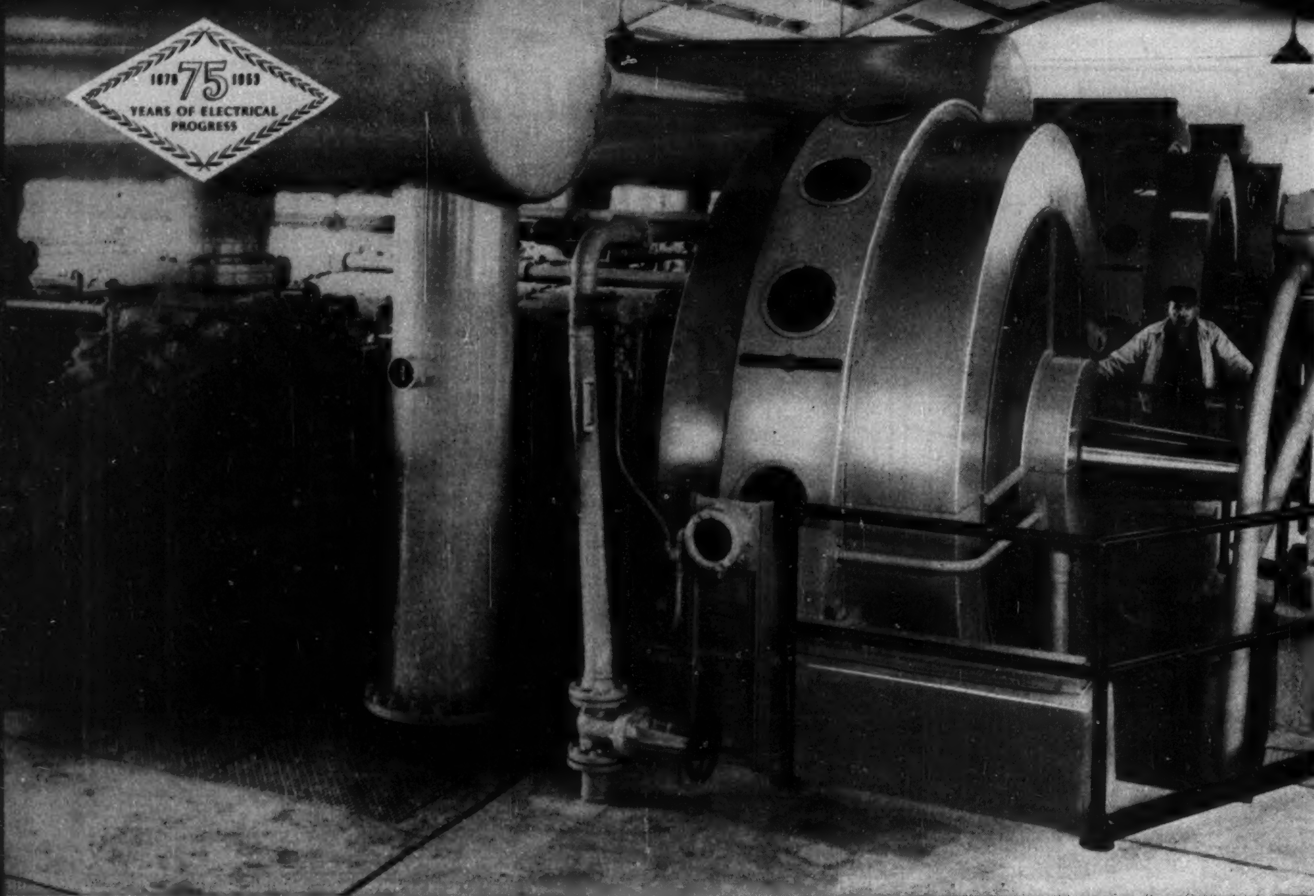
. . . Defense Program Lagging

How far along is our defense program? According to E. Carl Mattern, assistant deputy administrator, Petroleum Administration for Defense, we have built only half a bridge. "Congress . . . has said over the past 18 months that some $130 billion should be spent on military procurement and construction. As of August 1, though, only $34 billion worth of goods and facilities had been delivered —just a little better than a quarter of the authorization.

"Another $46 billion worth were somewhere along the line from start to delivery. Still another $50 billion of authorized appropriations had not even been committed on contract," says Mattern.

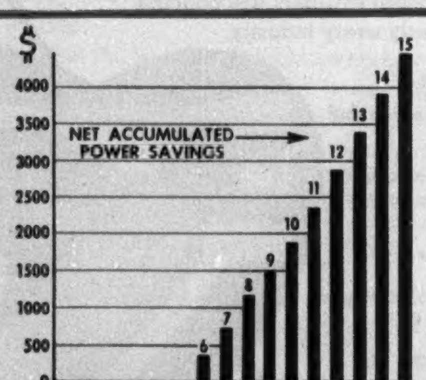
Henry H. Fowler, administrator of the Defense Production Administration and the National Production Authority, puts it this way: "If there were deliveries on outstanding orders plus the unplaced orders at the current rates of delivery, we should still be 40 months away from completion of this program. The challenge to the nation is to continue to increase sharply the rate of deliveries so that we can accelerate the achievement of this production in a shorter period."

—*End*



COMPRESSORS IN A GAS STORAGE STATION are driven by General Electric 3000 hp, 300 rpm synchronous motors.

Can synchronous motors cut

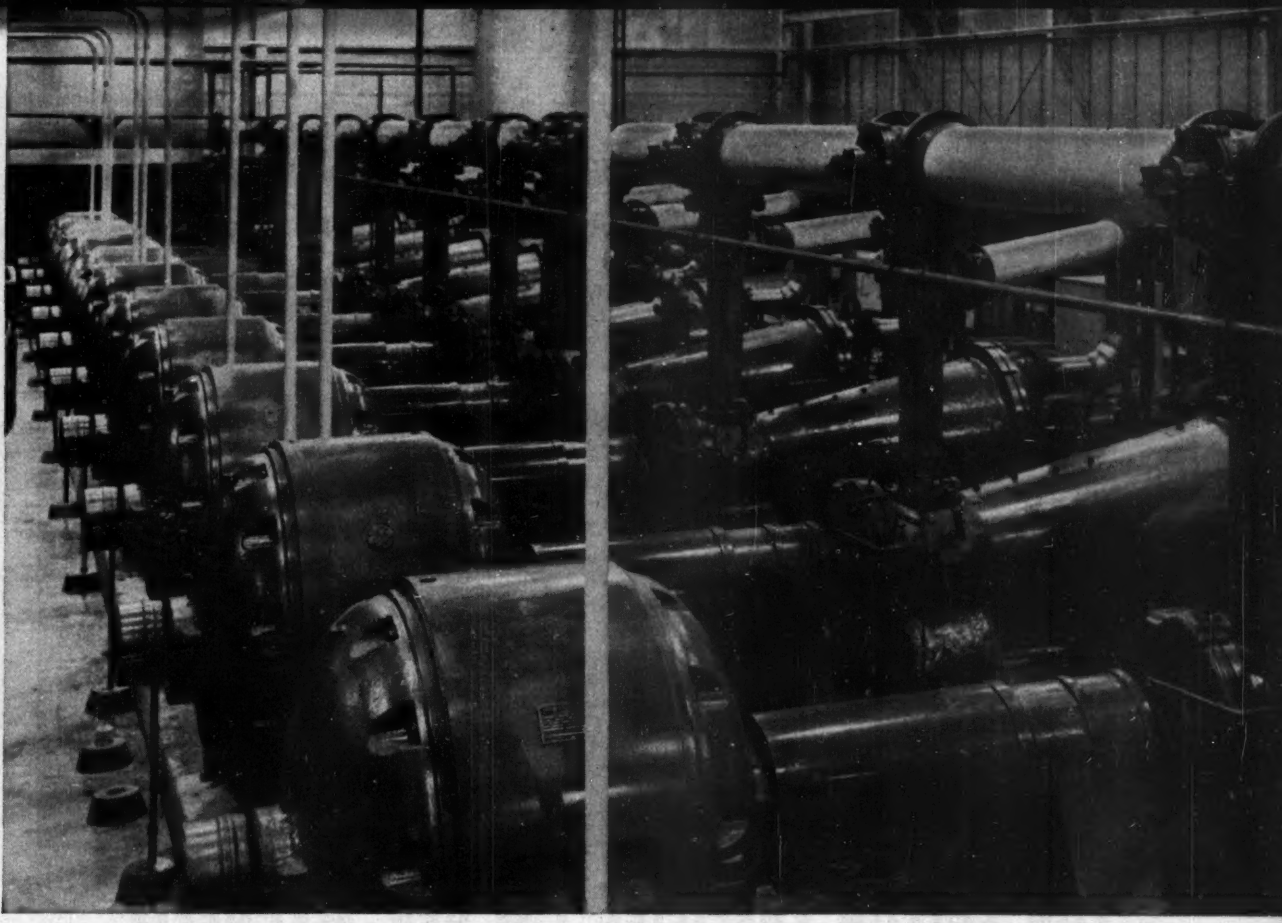


OPERATING SAVINGS on the synchronous motor application described above are shown over a period of twenty years. Extra first cost will be amortized in five years; savings will continue for many more.

Here's how one plant saves with a G-E Synchronous Motor

The specifications for a new pump motor were 250 hp, 600 rpm, 2300 volts, 3 phase, 60 cycle. The price of a 1.0 Power Factor synchronous motor, including exciter and control, was higher than an equivalent squirrel-cage induction motor with control. However, the synchronous motor efficiency, including exciter loss, was 1.6% higher than the induction motor (93.0% vs 91.4%). Since the motor was to operate continuously at a power cost of 11 mils per kilowatt-hour, it was found that the power savings would repay the additional investment in only five years. The operating savings will continue throughout the life of the motor—10, 20, even 30 years.

Savings such as these make synchronous motors the most economical drive for many heavy-duty, continuous-service applications. And in many cases, synchronous motors are lowest in first cost, too.



GENERAL ELECTRIC 400 HP SYNCHRONOUS MOTORS are coupled to ten Jordans in a paper mill.

your plant's operating costs?

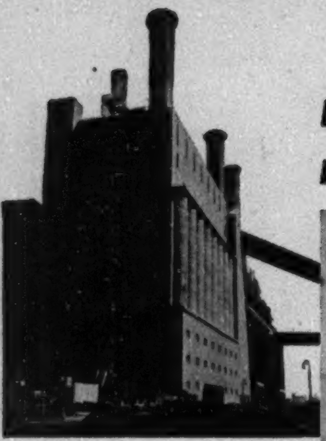
Greater Efficiency on Large, Constant-Speed Applications Can Lower Power Costs Substantially

On certain applications selection of General Electric synchronous motors can bring about substantial savings in plant operating costs. Synchronous motors usually have a higher full-load efficiency than any other type of motor, produce more work per dollar's worth of power consumed.

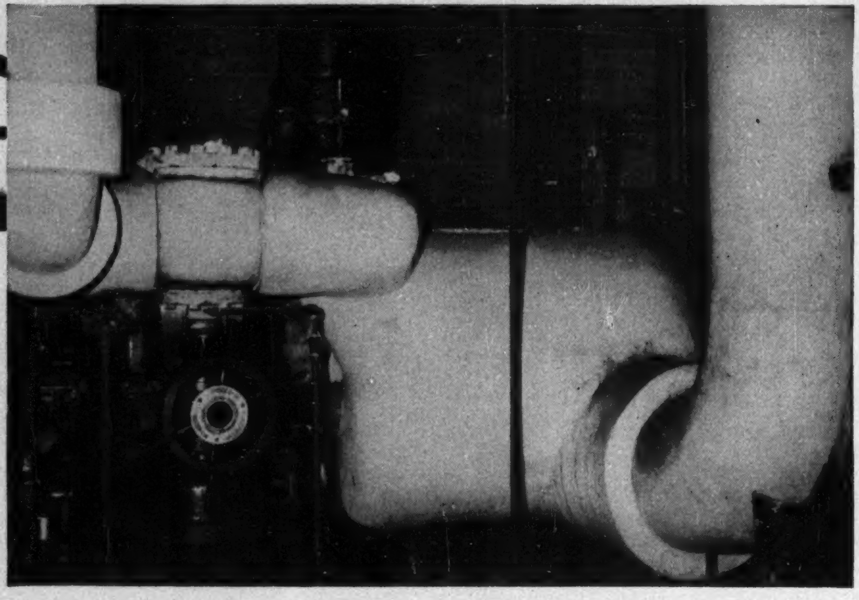
Furthermore, synchronous motors may be able to improve plant power factor—the ratio of total kilowatt load to total kva load. When these two fall out of balance, high system losses, high power bills, or increased maintenance costs commonly result. Using a *unity power factor* synchronous motor adds only to total kw load. And, a *leading power factor* synchronous motor will actually supply reactive kva's to your system, while operating at its normal rated output.

Before you select a drive for a large piece of equipment providing heavy and continuous service, be sure to investigate the economics of General Electric synchronous motors. Call in your G-E representative —he'll be glad to discuss your situation with you. Also, information on G-E synchronous motors and their application is available in the following bulletins: GEA-5332, "Low-Speed Synchronous Motors;" GEA-5426, "High-Speed Synchronous Motors;" GEA-5817, "Plant Power Factor Improved With G-E Synchronous Motors." Write to Section 770-27, General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC



For this new addition to their New York City power plant at East River and 14th Street...



(Above) View of recently completed annex to Consolidated Edison's power plant... another link in their gigantic expansion program. **(Right)** Close-up of J-M 85% Magnesia Insulation on boiler feed lines. It was expertly installed by the Asbestos Construction Company, Inc., an outstanding J-M Insulation Contractor.

CON EDISON SPECIFIES J-M 85% MAGNESIA PIPE INSULATION FOR MAXIMUM FUEL SAVINGS

Like all materials that went into the new power plant addition of New York's leading gas and electric supplier... the pipe insulation had to be the *best*. That's why Consolidated Edison Co. specified J-M 85% Magnesia... industry's No. 1 insulation for many decades and *still* the leader in its class.

J-M 85% Magnesia is the leading insulation on the market for temperatures up to 600F. It is bonded with asbestos fibers. This rugged insulation will not distort regardless of the length of time it stays in service. J-M 85% Magnesia fits snug and stays put. Heat savings, therefore, remain constant for the life of the equipment on which this insulation is applied.

For temperatures over 600F, J-M 85% Magnesia is used in combination with Superex*, a J-M insulation for service to 1900F. This double-layer construction, known as Superex Combination, eliminates through joints and protects the jacket against scorching. It also utilizes the higher heat resistance of Superex next to the hot surface, and the greater insulating value of J-M 85% Magnesia for the outer layer.

*Reg. U.S. Pat. Off.

Experience has proved that all insulations must be properly installed to pay maximum dividends. That's why Johns-Manville offers industry the services of experienced insulation engineers and installation contractors who have made a career of solving complex insulation problems. From coast to coast, these engineers and the contractor's highly skilled mechanics stand ready to combine their talents and give you an insulation job that will more than pay off your initial investment with maximum fuel savings through the years.

When you face your next insulating problem... remember that Johns-Manville is "Insulation Headquarters." Consult your near-by J-M Insulation Contractor... or write direct to Johns-Manville, Box 60, New York 16, New York. In Canada, write 199 Bay Street, Toronto 1, Ontario.

Skilled Applicators on the team of a J-M Insulation Contractor applying J-M 85% Magnesia to pipelines. Located throughout the nation, these contractors have had years of experience handling all types of installations. They know J-M 85% Magnesia and other J-M insulations as *quality* products, and take pride in applying them properly. Result: an insulation job that pays dividends through the years in maximum fuel savings.

Johns-Manville *FIRST IN* INSULATION

MATERIALS • ENGINEERING • APPLICATION

Chemical Engineer's Bookshelf

Edited by Lester B. Pope

No Solace

MIXTURES. By E. A. Guggenheim. Oxford University Press, New York. 270 pages. $8.50.

Reviewed by F. C. Nachod

A chemical engineer who only reads but the main title and hopes to find a solution to a problem dealing with mixtures by consulting this book is in for considerable disappointment. Written by a master of thermodynamics Dr. Guggenheim's text is a fine contribution to the bookshelf of the theoretical chemist. The usefulness is apparent from a passage of the preface: "The models can be expected to be useful representations of only the simplest mixtures. In particular, mixtures containing electrolytes or highly polar molecules are entirely excluded from consideration. Comparison between theory and fact is limited by the scarcity of precise experimental measurements on the simpler systems. Where comparison is possible the result is nearly always surprisingly gratifying."

Students and teachers of thermodynamics will be pleased with the present work but practicing chemists and engineers will find no solace in it, unless they have a theoretical flair they wish to exercise.

Source Material

MALEIC ANHYDRIDE DERIVATIVES. By Lawrence H. Flett and William Howlett Gradner. John Wiley & Sons, New York. 269 pages. $6.50.

Reviewed by A. R. Surrey

Some 116 different types of reactions involving maleic anhydride and derivatives have been incorporated in this book. For each reaction there is a brief experimental procedure, some selected references, and possible uses for the products. A chemist interested in a problem involving maleic anhydride should have no difficulty finding useful information on the subject in this collection of reactions.

Many of the reactions are specific for maleic or fumaric acid derivatives. This is obvious in those cases where more than one functional group is involved. The reactions which involve only the double bond offer greater general interest to the organic chemist who may find procedures and references for his particular problem. However, one must bear in mind that a highly active ethylenic bond is involved and the reactions and procedures may be representative in only a small number of instances.

For many of the reactions described no recent references are found. No statement is made by the authors as to whether the selection of references was made to include the latest available information on the reactions described.

The book is well organized and presents to the synthetic organic chemist a readily available and valuable source of material regarding the chemistry of maleic anhydride derivatives.

Textile Technology

TEXTILE CHEMICALS AND AUXILIARIES. Edited by Henry C. Speel. Reinhold Publishing Corp., New York. 493 pages. $10.

Reviewed by R. Eck

Written by a number of specialists, this book will be welcomed by everyone concerned in any way with the application of chemicals or auxiliaries to textiles. The title is an understatement. Lists of textile chemicals and auxiliaries are available in such standard references as the "Textile Chemical Specialty Guide," the Year Book of the AATCC, etc. However, these lists give only a sketchy idea of the individual product as well as its application. As a matter of fact, the present volume could be justly called "Fundamentals of Chemical Textile Technology."

This one-volume text should be a boon to many textile men who are too busy to read either the journals or voluminous textile books. Instead, this book presents modern views in a most concise and digestible form. The ample bibliographies will be cherished by numerous chemists working on new auxiliaries. For this group of readers the first part of the book is apt to serve as a quick introduction to their problem.

It was a good idea to have the main part preceded by a first part on "The Nature and Processing of Fabrics." The first chapter contains most helpful comparisons of the older and newer fibers. Through other chapters a good bird's-eye view will be obtained of the various fields of auxiliary application, such as sizing, desizing, scouring, dyeing and printing. The chapter on finishing by an experienced practical specialist (H. H. Mosher) will be most appreciated. A treatise on "Coated Fabrics" concludes the first part.

The main part consists of 16 chapters on "Raw Materials in Fabric Processing." There are several excellent chapters, especially those on surfactants and one on synthetic resins. The one on "Cationic Finishing Agents" (by R. W. Ackley) is outstanding. Included in the main part are three chapters on finishing for special purposes, namely water repellency, flameproofing and mothproofing, the last one making use of photographs.

In a symposium of this kind a certain amount of overlapping is unavoidable. However, it is to the credit of the editor that the reappearance of a specific subject is, as a rule, not considered as a repetition but rather welcomed as a supplement.

The treatment of trade names varies somewhat with the different authors. The same holds to the usage of some textile terms: for a person unfamiliar with these it might be puzzling to read about "Crushproofing" in one chapter, in other chapters about "Crease resistance," while both terms mean the same thing. A shortcoming is the lack of a list of chemical "carriers" for the dyeing of Dacron. Textile testing is not uniformly treated. In the main, only bibliographical information is given. In Chapter 20, however, valuable space is consumed by copying methods which are easily available from other sources. The subject index should be checked in order to be of full value.

These criticisms, however, are of minor importance in comparison to the real accomplishment which this book has obtained, namely in presenting an important branch of industrial chemistry in a clear, pleasantly readable manner.

Recent Books & Pamphlets

Subject	Summary	How to Order
Piping	Complete code for pressure piping, covering power, gas and air, oil, district heating and refrigeration piping. 34 pages.	"Section 8 of the Code for Pressure Piping." American Society of Mechanical Engineers, 29 West 39th St., New York 18, N. Y. $1.25.
Thermal Conductivity	List of published reports on methods of measuring thermal conductivities of liquids and solutions at applicable temperatures. Presents only experimental methods and does not include references to theoretical work. 70 pages.	"A Literature Survey of the Thermal Conductivity of Liquids." By Byron C. Sakiadis and Jesse Coates. Bulletin 34, Engineering Experiment Station, Louisiana State University, Baton Rouge 3, La. $1.
Corn	The many and varied uses of products from corn in both the food and industrial fields. Processes by which corn starch, syrup and sugar and such byproducts as corn oil and various feedstuffs are made. Future potentials of the grain. 64 pages.	Corn Industries Research Foundation, 3 East 45th St., New York 17, N. Y.
Testing Materials	A 50-year index to all ASTM technical papers and reports dealing with materials, particularly their properties and testing. Information may be located by subject or by author. Cloth binding. 216 pages.	American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. $6.
Air Pollution	First of a series of appendices to the bibliography on air pollution contained in the association's manual on the subject. 20 pages.	Manufacturing Chemists' Association, 246 Woodward Bldg., Washington 5, D. C. 35 cents.
Plastics and Synthetic Rubber	Abstracts of patent applications by such firms as Farbenfabriken Bayer, Badische Anilin- & Soda-Fabrik and other well known German and Austrian manufacturers. Contains 44 reports divided into four sections: silicones; vinyl and ethylene compounds; oil-modified polystyrene resins and styrene copolymers; elastometers. 12 pages.	Bulletin 72. Research Information Service, 53 Nassau St., New York 38, N. Y.
French Technology	A collection of articles written on technological progress in various industries during the past half-century. Specialists write on such fields as electrochemistry, organics,. explosives, pharmaceuticals, plastics, fermentation, perfume, glass. 378 pages.	"Cinquante Ans de Perfectionnement Technique." Centre de Perfectionnement Technique, 28, Rue Saint-Dominique, Paris 7, France. 4.120 fr.
Ethyl Alcohol	Statistics on ethyl alcohol for the fiscal year ended June 30, 1952. Production and consumption broken down by end use, by states and by month. 10 pages.	Treasury Dept., Bureau of Internal Revenue, Alcohol and Tobacco Tax Div., Washington, D. C.
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(Continued)

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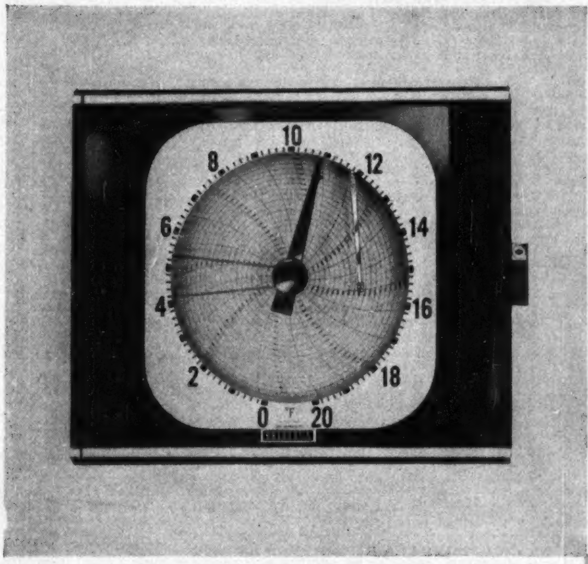

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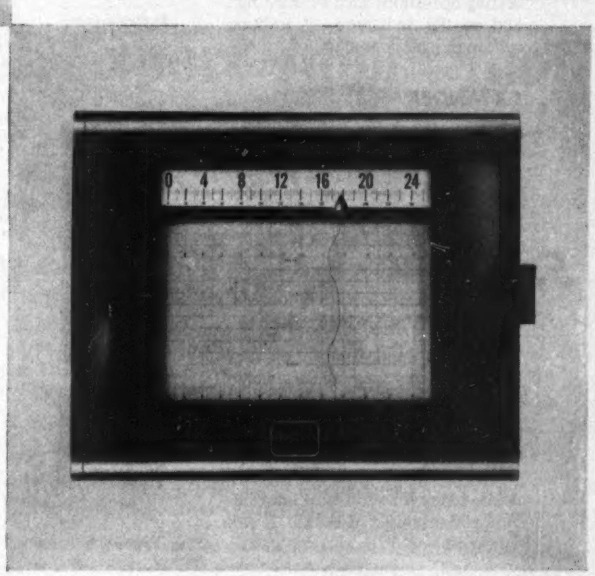

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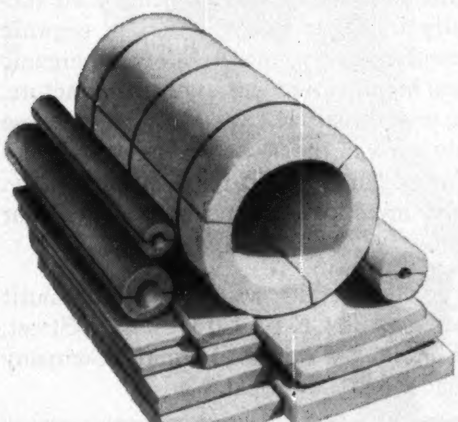

First, Kaylo Heat Insulation is *proved* a *better* material—hydrous calcium silicate. Its light weight, strength, water-insolubility, low conductivity and wide temperature range give you extra advantages *at no extra cost.*

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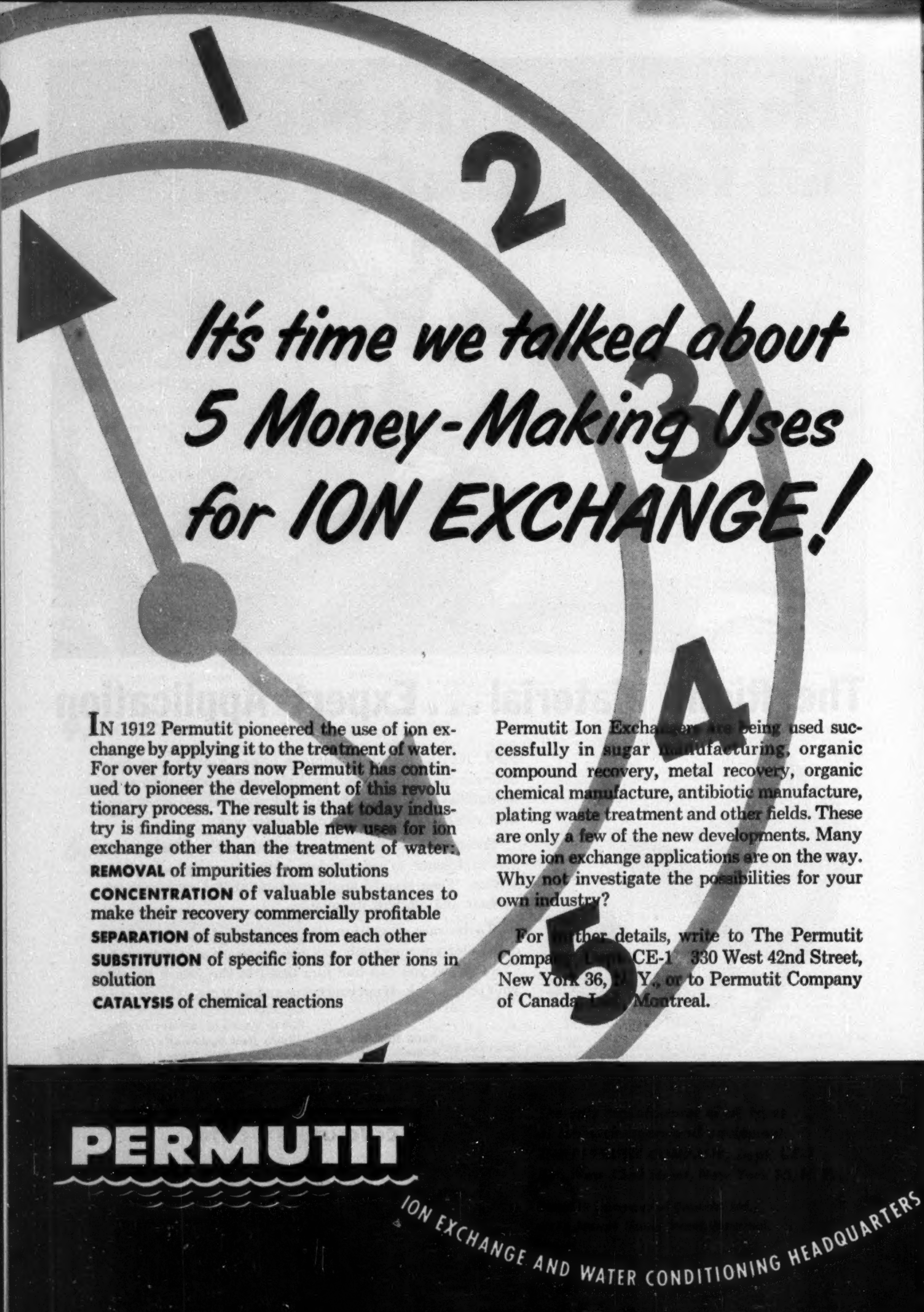
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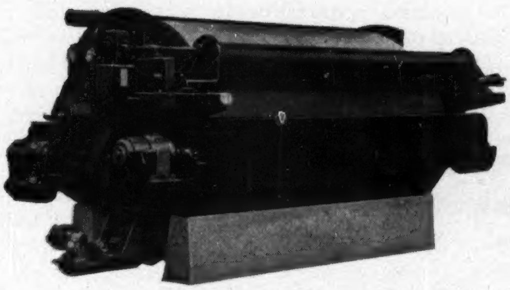
OLIVER

Precoat FILTER

Panel FILTER

Each the Nemesis of Pulps Forming Thin, Sticky, Flow-Retarding Cakes



• The Oliver Precoat Filter operates in continuous cycles with a pre-formed 'precoat' of suitable porous material such as diatomaceous earth. Solids form a thin film on the surface of this precoat which is shaved off by a traveling knife edge as the drum rotates, leaving continually a fresh surface of precoat for cake deposition. Actual filtration continuous for periods ranging from 8 hours to several weeks before the precoat is used up and a new one has to be formed. Precoating takes an hour or two.

• The Oliver Panel Filter in contrast to the Precoat Filter doesn't use a precoat. Nor is there any wire winding to hold the cloth on the drum. An ingenious discharge mechanism picks the thin cake off the cloth leaving it clean and ready for further cake deposition. The cloth is in a relatively small piece and is held in place by caulking into recesses between sections.

WHY two distinctly different filters for handling pulp forming one class of filter cake? Another question answers that one: "What do you want to do with the cake? Keep it or throw it away?"

The Precoat Filter makes use of a pre-formed layer or 'precoat' of filter aid which, as it is removed with the cake, mixes with it. Usually such cakes are discarded, although it is often possible to separate the solids from the precoat by a suitable solvent.

The Panel Filter does not use a precoat or pre-formed layer of filter aids. Thus it discharges the solids uncontaminated in any way. It, too, handles easily those thin, sticky, flow-retarding cakes. It is usually recommended when the cake is valuable or is to be processed further. We call these two filters to your attention in case you wish to obtain the advantages of continuous and automatic filtration of a pulp that for one reason or another produces an extremely thin cake.

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 Howard C. Gary, McGraw-Hill Dept. of Economics

1953 Will Be a Better Year

Industry profits next year will be up 10 to 15 percent. And if the excess profits tax—which expires in June—is eliminated, the profits boost might be larger.

This outlook is based on the expectation that there will be a relatively high level of industrial activity next year powered, in large part by continued heavy military expenditures.

In the unlikely event that there is a serious general slump, the earnings of chemical companies will fall—but not to the extent that profits for all industry will drop. Some chemical companies that are hit hardest by the excess profits tax can withstand (if the tax is not renewed) as much as a 35 percent drop in pre-tax earnings without any noticeable decline in after-tax profits.

▶ **No Turning Point**—There is no reason to fear that the relatively unspectacular record of 1952 marks a turning point for chemicals.

In some circles there is concern that the postwar pace of plant expansion may have brought on overcapacity in the industry. The threat of foreign competition and tariff reductions by this country make these doubters even more jittery.

A look at the record is reassuring. During the past 25 years chemicals have had to expand facilities at an average rate of 10 percent a year, compared with a 3 percent average for all industry. And the basic forces responsible for this lively growth still exist today.

▶ **Bank on Research**—One of the major factors propelling the industry forward is the emphasis on research. Research means new products and new uses for older items. Research activity in chemicals is at an all-time high—and continues to advance. Companies that boosted sales fivefold in recent years probably increased research activities by at least that amount.

When the twin scourges of breakneck inflation and shortages no longer harass chemical managers they can then concentrate on bringing some of the products constantly turned out in their labs to the market. This work is neglected when—as has happened so often in the past decade—the industry has to strain to meet an overwhelming and urgent combination of military and industrial demands.

By bringing forth new products the chemical industry can do much to lessen the intensity and shorten the duration of any decline in earnings. Almost daily there are a stream of stories about new chemical developments. Here are a few examples of why industry leaders are optimistic:

▶ **Petrochemicals**—This industry offers a spectacular display of the value of industrial research. The onrush of chemical synthetics left the coal-tar and agricultural industries far behind; these old stand-bys just couldn't turn out sufficient raw materials. So petrochemicals are filling the gap.

But the petrochemical revolution has meant new gains for agriculture. Tremendous production of nitrogen fertilizers has enabled farmers to bring new land under cultivation and has stepped up their yield on more fertile farms. Much of our industrial alcohol now comes from petroleum or natural gas instead of the fermentation of grain and sugar. Additional land thus becomes available for food cultivation. It's a safe bet that within ten years petrochemical detergents will have taken over a large share of the packaged soap market. The fats and oils thus saved can be added to the nation's food potential.

There seems to be no limit in sight to the petrochemical horizon. Industry investment is already in excess of $2 billion. Sales in 1952 will include 8.5 million tons of chemicals with a value of more than $1.5 billion. The output in 1925 was 75 tons.

▶ **Plastics**—The plastics molding business is being reshaped by wider use of plastics for metals as large parts in such consumer goods as refrigerators and television sets. There are presently available 4,000-ton presses which can turn out four 50-lb. cabinets—for housing either television or radio sets—all at one time.

The trend towards larger plastic parts means that capital investment required in present-day compression molding is much greater than was formerly the case.

▶ **Latex Paint**—This new segment of the paint industry is fast becoming a top money maker for both manufacturers and dealers. The paint was first introduced during World War II. In 1947-48 a larger scale selling campaign was attempted.

At first the home consumer and the professional painter were indifferent. It took much research by chemical and paint companies to get the bugs out of the new product.

Sales figures tell the story. In 1950, 10 million gallons were sold. This had risen to 21 million gallons by 1951; preliminary estimates place the total for 1952 at more than 40 million.

Latex paint now represents about 15 percent of all trade sales in the paint, varnish and lacquer industry. This percentage is certain to grow.

▶ **Repellents**—Clothes that keep insects away because of an odorless, colorless repellent impregnated in its fibres may be just around the corner.

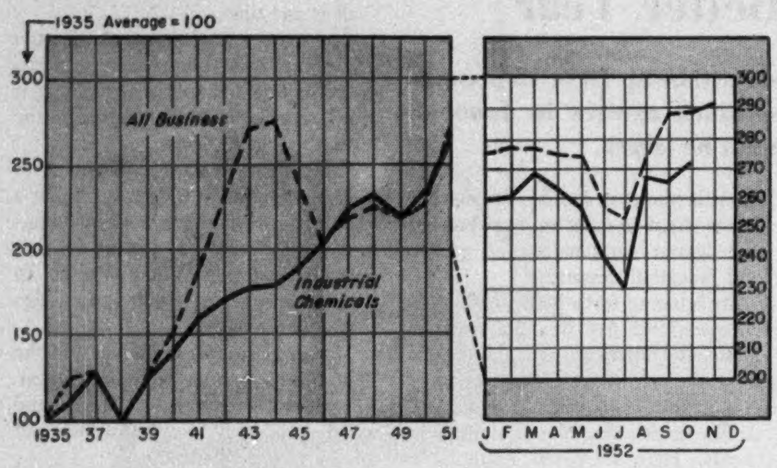
The Army has experimented with this new product—they call it Formula M-1960—in Korea. It worked well. The Army immediately decided to apply the repellent to all military garments as soon as supplies permit. The new repellent doesn't kill mites, fleas, ticks, mosquitoes, and leeches. It just keeps them away. According to the Army, the repelling effect lasts.

Another new repellent—this one to be applied to the skin—has just been announced by the Army. So far it has demonstrated a six hour effectiveness against the onslaught of mites, mosquitoes, biting flies, gnats and fleas. Army scientists expect to make considerable improvements in its span of effectiveness and appearance soon.

These new developments—and the hundreds of other examples that could be cited—are the hidden reserve of strength possessed by chemicals. The industry is always in a state of flux. The chemical engineer working in development today is the best guarantor of the industry's future tomorrow.

Process Industry Trends

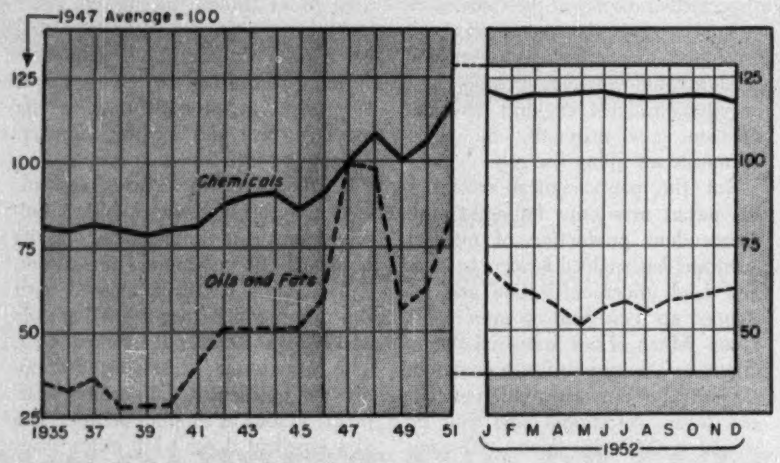
CONSUMPTION



Industrial Chemicals Index

	October (Est.)	Sept. (Prelim.)	August (Revised)
INDEX	272.00	266.44	267.28
Fertilizer		55.60	57.42
Pulp and paper	29.90	26.98	27.83
Petroleum refining	27.81	27.40	27.34
Iron and steel	17.96	17.13	15.59
Rayon	30.70	30.73	30.50
Glass		22.84	24.59
Paint and varnish		28.32	27.25
Textiles		10.84	11.31
Coal products		11.07	11.20
Leather		4.61	4.61
Explosives		9.57	9.02
Rubber	6.79	6.04	5.37
Plastics		15.31	15.25

PRICES

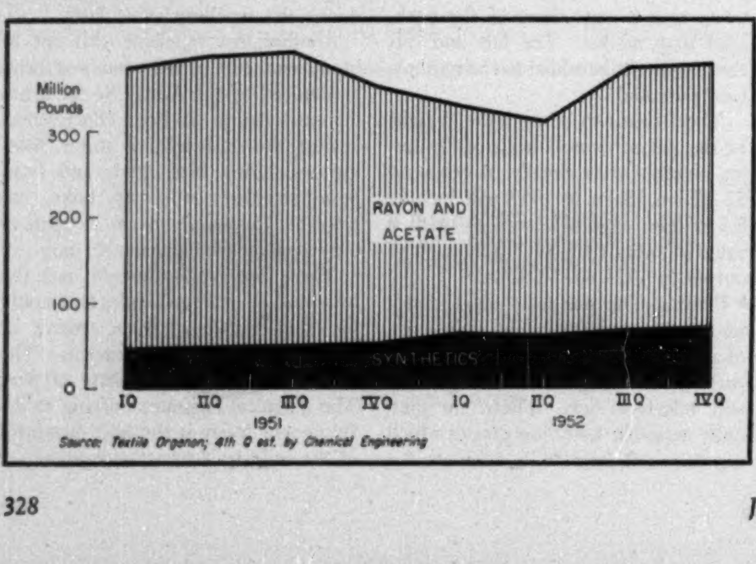


Chemical Engineering's Price Indexes

Chemicals	DOWN	−1.1%
Oils and Fats:	UP	+3.2%

	Chemicals	Oils & Fats
As of December 1, 1952	117.71	62.93
Last month	119.06	60.98
December, 1951	120.94	71.12
December, 1950	115.44	82.77

HIGHLIGHT OF THE MONTH



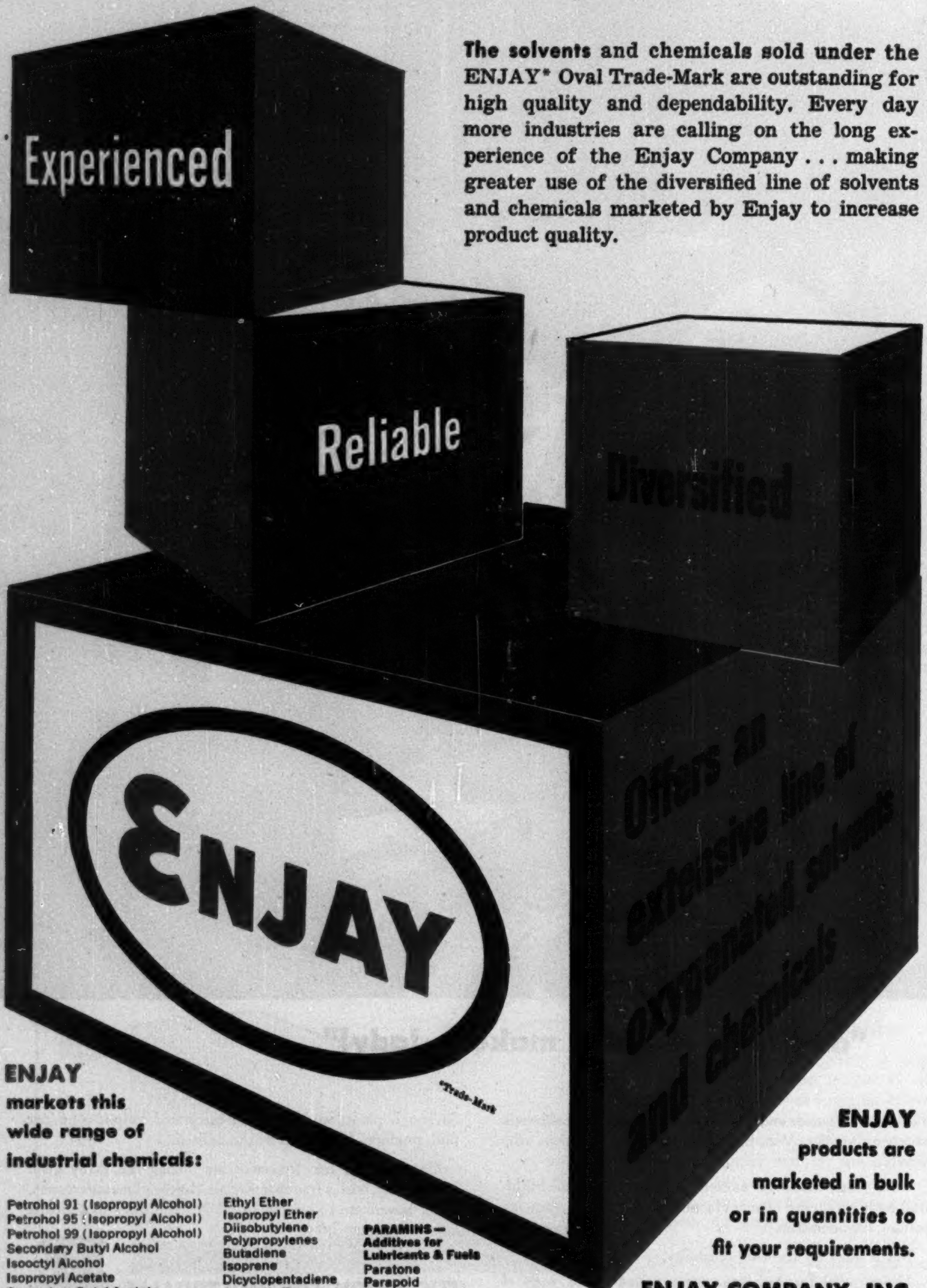
Source: Textile Organon; 4th Q est. by Chemical Engineering

Your Neighbor's Troubles

Textile boom dies before it gets under way. November output of all textiles averaged about 5 percent below the recent September high (seasonally adjusted). It appears that the textile industry cannot work at full or near full capacity for any length of time without some trouble developing—inventory, demand or price.

Third quarter output of synthetic fibers showed a 20 percent increase over the very poor second quarter results. But current figures indicate another build-up of stocks is taking place.

The solvents and chemicals sold under the ENJAY* Oval Trade-Mark are outstanding for high quality and dependability. Every day more industries are calling on the long experience of the Enjay Company . . . making greater use of the diversified line of solvents and chemicals marketed by Enjay to increase product quality.



ENJAY markets this wide range of industrial chemicals:

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Secondary Butyl Alcohol
Isooctyl Alcohol
Isopropyl Acetate
Secondary Butyl Acetate
Acetone
Methyl Ethyl Ketone

Ethyl Ether
Isopropyl Ether
Diisobutylene
Polypropylenes
Butadiene
Isoprene
Dicyclopentadiene
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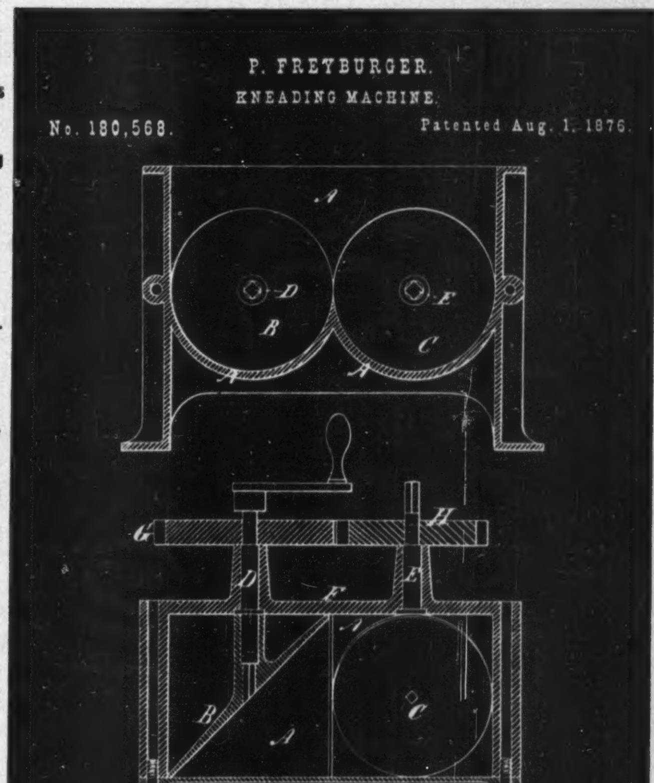

* The first double blade mixing and kneading machine, invented by Paul Freyburger in 1876 for the Werner Pfleiderer Company, which later became part of BAKER PERKINS INC.

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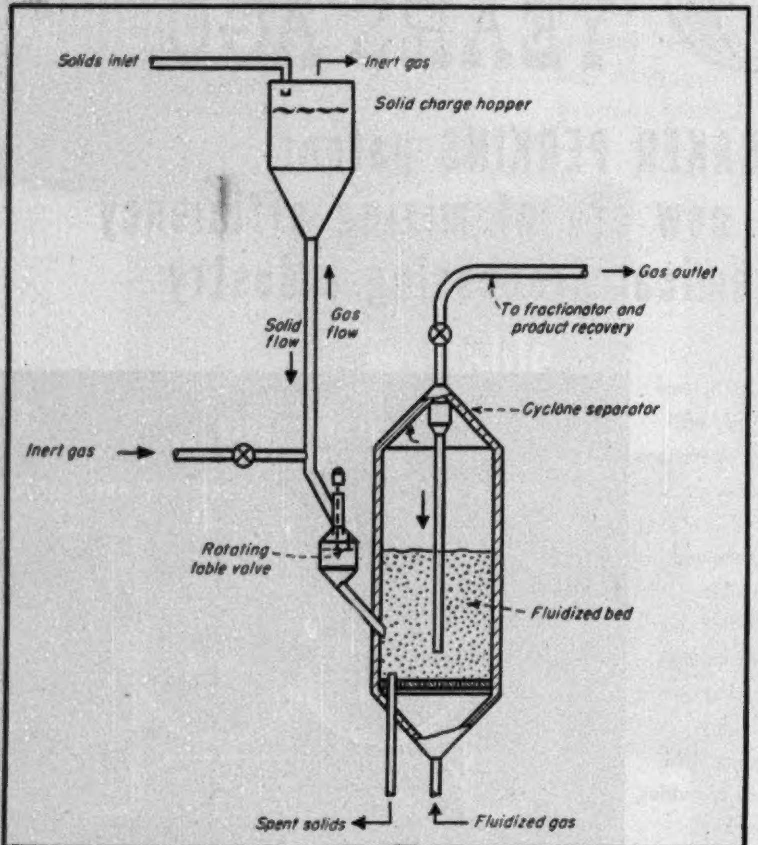


Novel Solids Feeding System

New standpipe system shows how non-fluidized solids might be fed into a fluidized bed reactor. It's designed for coal carbonization or gasification processes.

The usual way to feed solid particles into a fluidized bed reactor operating at a high pressure is to use an aerated standpipe. This has a fluidized column of solids high enough to give a pseudo-hydrostatic pressure greater than that in the reactor.

But this method will not work when the particles are as coarse as 0.10 in. (such as are commonly used in the carbonization or gasification of coal, lignite or shale) since it isn't possible to "fluidize" a long, narrow column of coarse particles.

Nor can a non-fluidized column of solids normally be used, since there is no compact mass in the reactor to control the flow from the solids leg.

▶ **Ogorzaly's Technique**—Now Henry J. Ogorzaly claims a new system specifically adapted to overcome these difficulties. He has assigned his invention (U. S. 2,613,832) to Standard Oil Development Co.

Ogorzaly uses a standpipe of non-fluidized solids (see *cut*). An inert gas such as air, introduced near the bottom of the standpipe, flows upward through the column.

Crux of the invention evidently hinges on having a column high enough to give a back-pressure of air slightly greater than the pressure in the reactor. This prevents loss of gas from the reactor to the standpipe. The solids flow continuously down through the standpipe and countercurrent to the gas.

Flow rate of the solids is regulated by a solids metering device such as the rotating table shown in the diagram. The pressure drop through the column must be kept less than the weight of the column of solids; otherwise there will be "slugging" of solids.

▶ **Use on Oil Shale**—Here is one of the examples given to show how the method might be used:

Suppose the feed is 7,000 tons per day of an oil shale ground to pass through a ¼-in. screen and with an apparent density of about 78 lb. per cu. ft. The feed hopper is at atmospheric pressure. The material is to be fed into a distillation zone maintained at about 15 psi. gage pressure.

According to the claims of the patent, all that's necessary is a shale column 32 ft. high and 24 in. wide—and 200 to 250 standard cu. ft. per min. of air injected into the base of the column.

MEET THE AUTHOR . . .

. . . MELVIN NORD

Tomorrow's Technology now becomes a monthly feature of *Chemical Engineering*. It's a service department you've asked for and we believe it's

one that you'll read regularly. So right now we're going to tell you a little about the author.

Melvin Nord is exceptionally well qualified to do this job for you. A chemical engineer himself, Dr. Nord is a four-degree man—three in chemical engineering (including his Ph.D.) and one in law (Ll.B.). He is now associate professor of chemical engineering at Wayne University in Detroit.

Besides his six years of teaching, Dr. Nord's practical experience in the chemical process industries also adds up to six years. Part of this was spent in plant design on gaseous diffusion processes for atomic energy. He has also done extensive consulting work in patents, equipment design and process design.

Dr. Nord has written many technical and legal papers—some 40-odd, according to his latest count. A number of these have appeared in *Chemical Engineering*, including his special report on Sublimation in our September 1951 issue. Next fall his "Textbook of Engineering Materials" will be published by John Wiley & Sons. And to top it all, he's already working on a book of legal problems for engineers.

He is an active member of many professional organizations: AIChE, AAAS, Sigma Xi, ACS, National Society of Professional Engineers, Engineering Society of Detroit. Dr. Nord is a registered professional engineer, a member of the Michigan and Federal Bars and a registered patent attorney.

It all adds up to an impressive record for a man of 34—married and with two children, too!

We welcome Melvin Nord as a regular contributor to *Chemical Engineering*. We believe his Tomorrow's Technology will be just what you've been asking for.

New Way to Remove Solid Condensed Vapors

In a drying or a sublimation process, solid condensed vapors may be removed continuously by causing the solids to deposit in a flowing liquid. So claims James R. Shields in U. S. 2,613,513 assigned to Blaw-Knox Co.

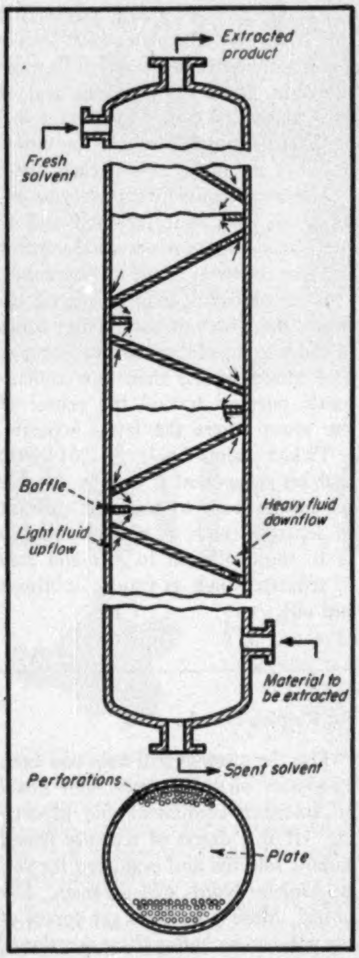
A shell-and-tube vacuum freeze-out condenser for condensing water vapor to ice is made continuous in the following way: Water vapor is fed upward through vertical tubes while a film of oil of low vapor pressure (such as dibutyl phthalate) runs down the inner surface of the tubes. As the vapor freezes, the ice particles are carried downward to a melting chamber below the condenser.

Heat applied in the melting cham-

ber causes the ice to melt. The water thus formed settles below an oil layer in the chamber, since the head of oil floating upon the water is sufficient to keep the water from flashing back to vapor. The water is then discharged by a pump.

This method is claimed to be particularly suitable for high-vacuum drying operations, including freeze-drying. It may also be used in other operations, such as sublimation, by making the appropriate modifications.

No information is given on the order of magnitude of heat-transfer coefficients that can be obtained in such an apparatus. It is undoubtedly an advantage to prevent the build-up of a solid film. Yet this is offset to some extent by the low rates of heat transfer obtainable through viscous liquids at low temperatures.



Liquid-Liquid Extractor Has Unusual Plate Construction

A novel type of perforated-plate tower for liquid-liquid extractions has

been developed by Richard B. Tickler and assigned to Standard Oil Development Co.

The tower is said to give high plate efficiency because it specifically provides for good mixing and good settling of the two liquid phases.

Plates are perforated at opposite ends, but not in the area between (see cut). Besides, they are placed at an angle from the horizontal (about 45 deg.) instead of horizontally. The plates thus form a zig-zag pattern in the tower.

In operation, the heavy liquid builds up on the top of each plate while the light liquid builds up beneath each plate. An interface between the two liquids is established in the space between each plate.

Enough pressure is thus provided at the edges of the plates that heavy liquid will be jetted downward through the light liquid at the lower end of each plate. In turn, light liquid will be jetted upward through the heavy liquid at the upper end of each plate.

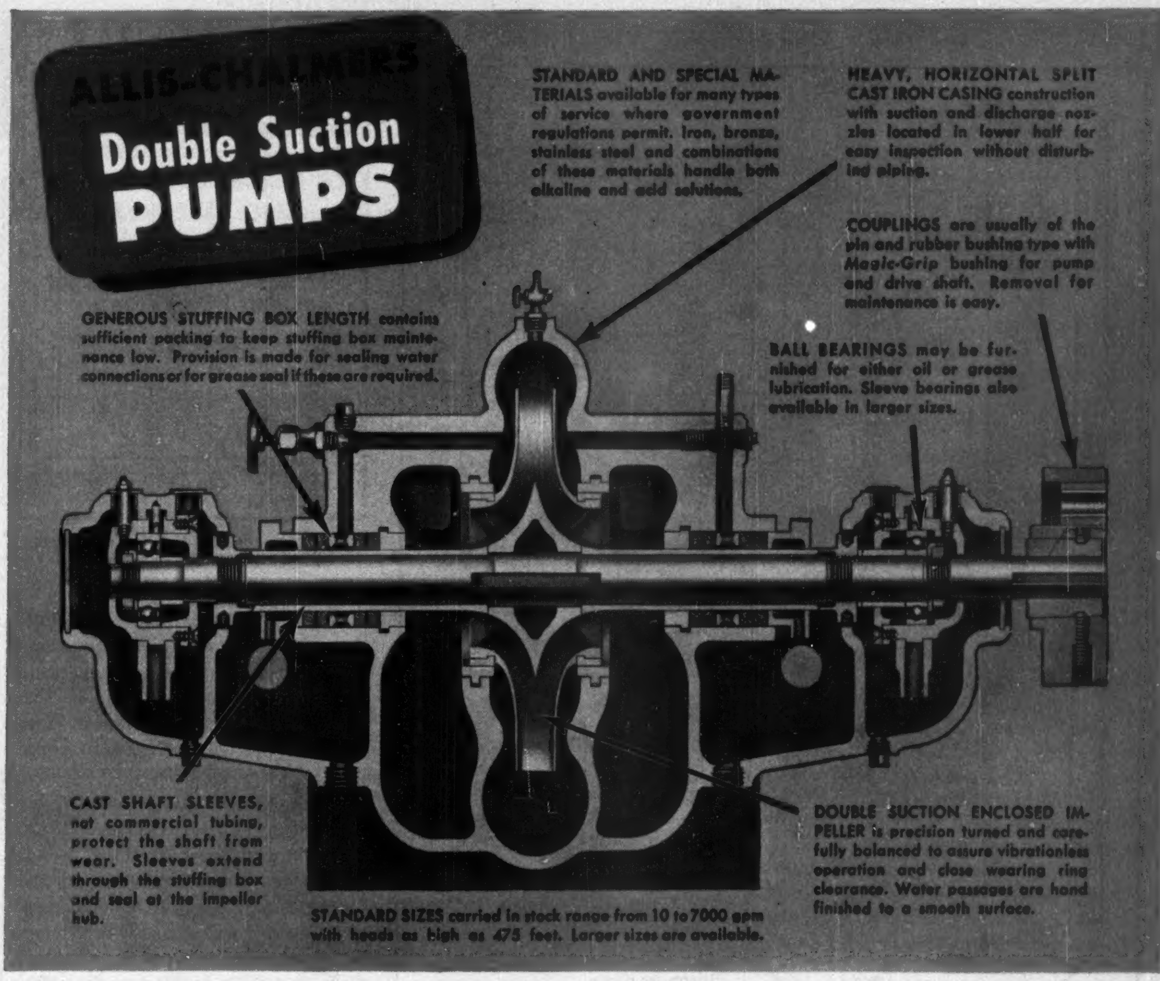
The two countercurrent streams impinge on each other at each end of the plates; this provides good contact in these relatively small mixing zones.

A set of baffles may be placed between the plates at the mixing zones in order to avoid excessive turbulence. The mixed liquids then flow concurrently outward toward the center of the tower where the layers separate.

Tickler claims (in U. S. 2,614,031) that his equipment is equally suitable for liquids easy to mix but difficult to separate (such as phenol and oil) or to those difficult to mix and easy to separate (such as caustic solutions and oil).

For Keeping Posted . . .

This department will help you keep up-to-date on what's new and novel in American equipment and processing. It is a digest of recently issued patents selected and evaluated for you by Melvin Nord, 664 Putnam, Detroit 2, Mich. You can get copies of any patents, including those mentioned here, by ordering from the Commissioner of Patents, Washington 25, D. C. They cost 25¢ each. Do not send stamps.



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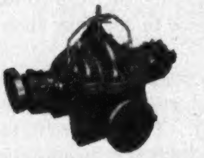

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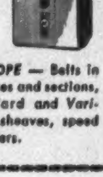

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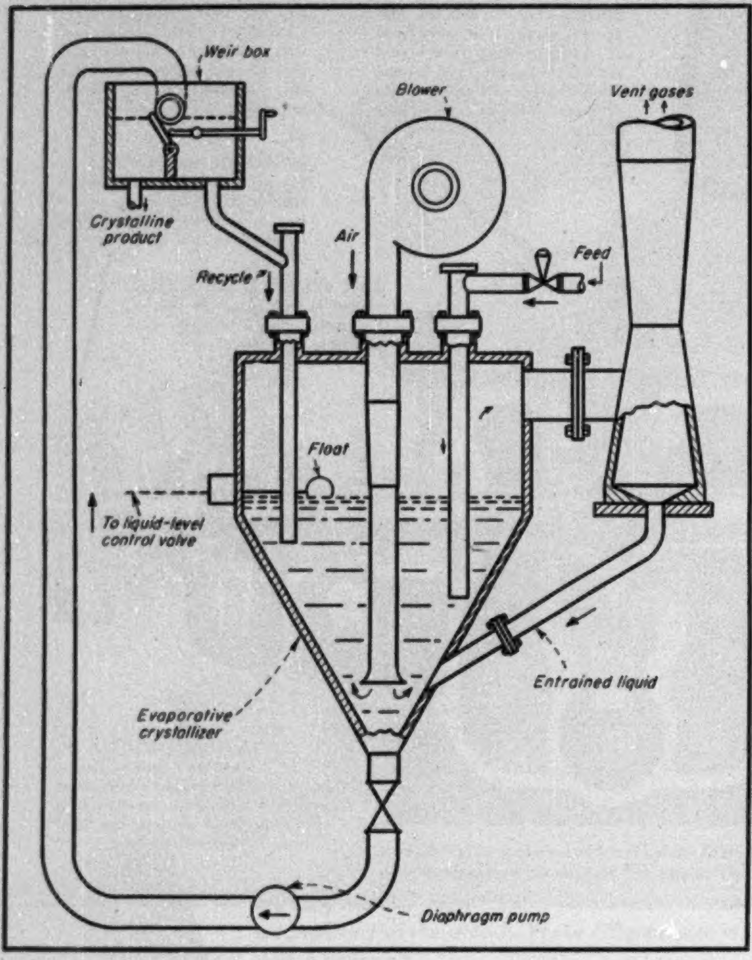

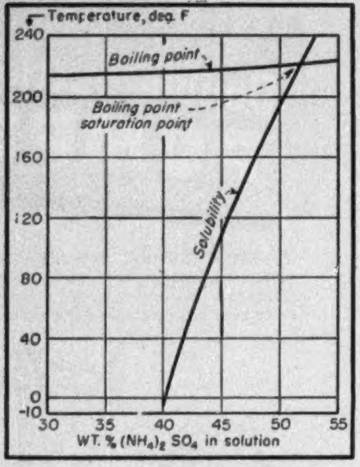

Ammonium Sulphate Crystallizer

Crystals of controlled size and shape can be made by blowing air through a saturated salt solution. The process is continuous, combines evaporation and crystallization.

Essential feature of the Robinson continuous evaporative crystallization process (see cut) involves blowing an inert gas (such as air) through the liquid. This evaporates water from the solution and also cools it; each of these helps to form crystals.

The new process, developed by Sam P. Robinson and assigned to Phillips Petroleum Co., can be used to prepare ammonium sulphate or other crystals of controlled size and shape. It is described in U. S. 2,614,035.

Feed to the crystallizer is a saturated salt solution at a temperature 1 to 25 deg. F. below the "boiling point saturation limit." This limit is shown (see cut) for the system ammonium sulphate-water.

Here the solubility of ammonium sulphate in water is plotted as a function of temperature in the lower curve; the normal boiling point of ammonium sulphate solutions is plotted in the upper curve. The point of intersection of these curves is the "boiling point saturation limit"; it indicates the maximum solubility (and maximum boiling point) of ammonium sulphate solutions at atmospheric pressure.

▶ **How It Works**—Feed solution is led into the evaporative crystallizer until the desired liquid level is reached; thereafter it feeds in automatically under liquid control. Air is then blown through the solution to cause evaporation and cooling, with consequent crystal formation.

Normally the rate of air flow is adjusted so as to maintain a crystallizer temperature of about 145 to 150 deg. F. At this temperature, air will evaporate as much as 11 times as much moisture as it will normally carry (even if it is saturated at room temperature). Cooling to too low a temperature is economically undesirable, since the quantity of air needed goes up rapidly.

Air provides excellent agitation of the whole solution. As a result, the crystals are automatically classified or sized. The turbulent motion carries the small crystals to the top—thus gives them a chance to continue their growth.

Larger crystals settle to the bottom and are removed continuously by a diaphragm pump. They are sent to a weir box which splits the stream into product and recycle streams.

The ratio of recycle to product is in the range 1:1 to 5:1. This is necessitated by the fact that too much crystallization will occur unless high liquid flow rates are maintained. The recycle enters the crystallizer below the liquid level. The product stream contains crystals suspended in mother liquor. These are separated from the liquid in external crystal recovery equipment.

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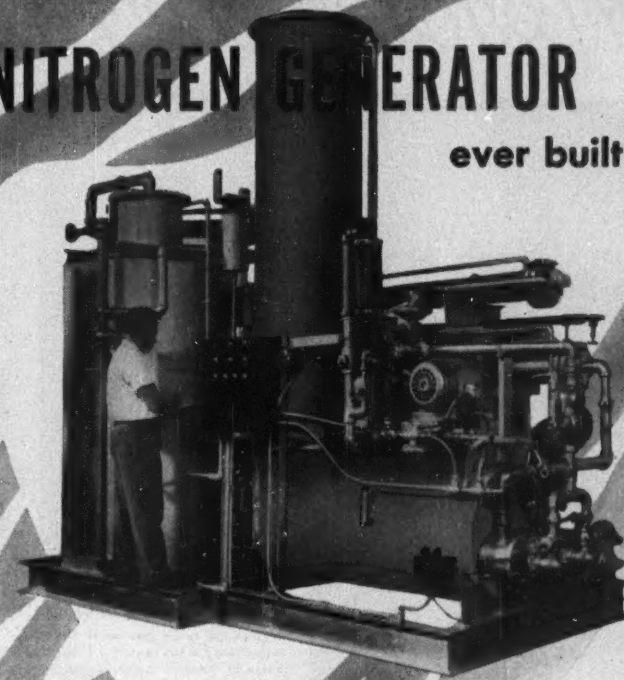

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the stack, where it drains back to the crystallizer.

▶ **Ammonium Sulphate Crystals**—Here is how the process is said to work on ammonium sulphate.

Concentrated ammonium sulphate solution boiling at 205 deg. F. is fed to the evaporative crystallizer. Cooling air at 80 deg. F. and 50 percent relative humidity is introduced into the hot solution at the rate of 25 cu. ft. per min. This cools the solution to 150 deg. F. At this temperature 8.8 lb. of crystals are recovered per 100 lb. of feed liquor.

Cooling to 145 deg. can be brought about by using 30 cu. ft. per min. of air. This will give a recovery of 10.2 lb. of crystals per 100 lb. of feed liquor.

Cooling to 120 deg. F. requires 72 cu. ft. per min. and gives a recovery of 12.7 lb. of crystals.

Fine Metal Powders

Metal powders of very small particle size and uniform size distribution are produced by thermally decomposing a metal carbonyl in a reactor and feeding in vapors of a liquid that boils above the decomposition temperature of the carbonyl.

The metal deposits on liquid nuclei produced by the condensation of vapors of the added liquid. The process is described in U. S. 2,612,440 by G. O. Altmann (assigned to General Aniline & Film Corp.)

Salt as Extractive Solvent

Salt solutions can now be used as the extractive solvent to separate water-miscible aliphatic alcohols which form close-boiling aqueous azeotropes difficult to separate by ordinary fractional distillation.

This new extractive distillation process is described (U. S. 2,612,468) by Charles E. Morell and Edwin R. Gilliland. It is assigned to Standard Oil Development Co.

Salt content of the extractive solvent may be from 1 to 10 mole percent. The liquid passing down the extractive distillation tower contains at least 60 mole percent water.

The higher molecular weight alcohol is taken overhead with water from the extractive distillation tower. A dilute aqueous salt solution of the other alcohol is taken as bottoms.

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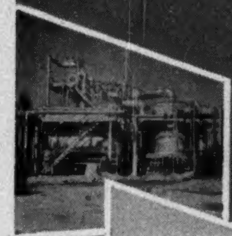

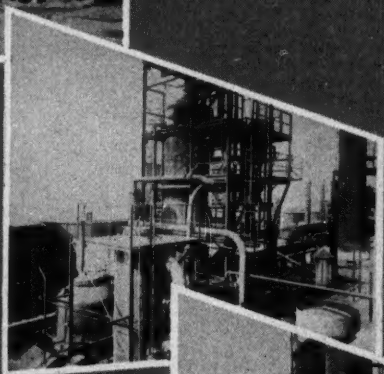

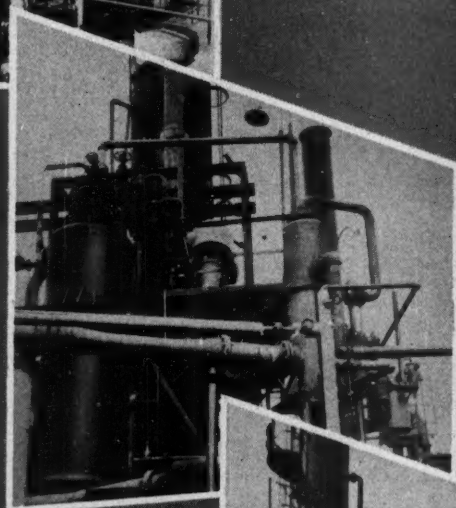

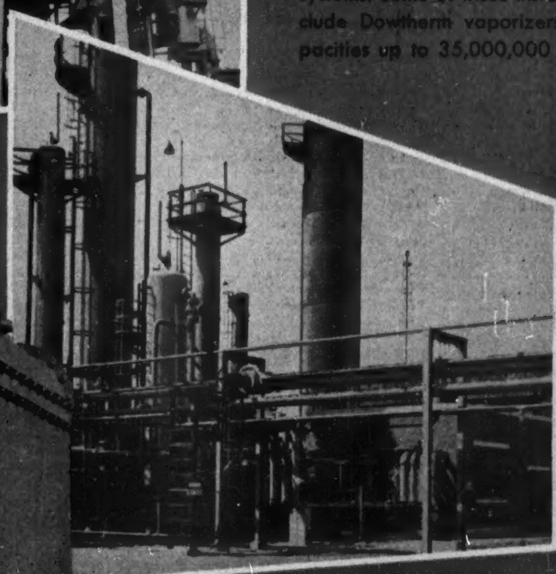

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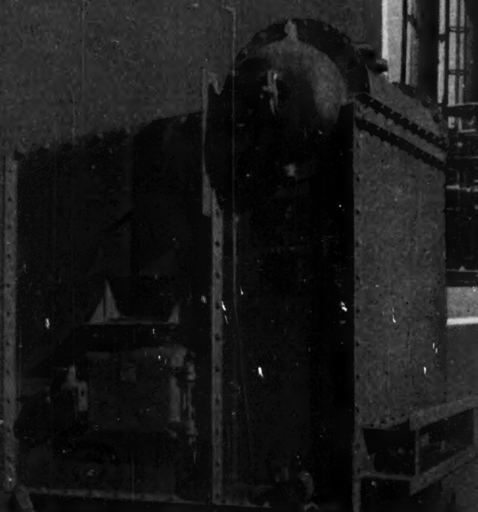

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Your Checklist of New Equipment Patents

Operation . . .	About . . .	Inventor or Assignee . . .	Patent No. . .
Crystallization	Fractional crystallizer	Phillips Petroleum Co	2,613,136
Drying	Tower for cooling & classifying spray-dried particles	Colgate-Palmolive-Peet Co	2,612,266
Distillation	Bubble cap & holddown device	Braun & Co.	2,612,360
	Falling film vacuum still with rotating partial condenser	Pure Oil Co.	2,613,176
	Short path fractionating stills	Metropolitan-Vickers Electrical Co., Ltd	2,614,973
Evaporation	Low-pressure flash evaporator	Bethlehem Steel Co	2,613,177
Extraction	Countercurrent extraction of solids	Michael Bonotto	2,614,911
Fusion	Fractional fusion	Phillips Petroleum Co	2,614,908
Gas-Solid Contacting	Annular stripper	Standard Oil Development Co	2,612,433
	Fluidized bed catalytic reactor	Standard Oil Development Co	2,612,437
	Fluidized solids contactor	Standard Oil Development Co	2,612,438
	Gas-solid countercurrent reactor	De Directie van de Staatsmijnen in Limburg	2,613,138
Heat Exchange	Expansion-compensated counter-current heat exchanger	Griscom-Russell Co	2,612,350
	Regenerative furnace of pebble type	Food Machinery & Chemical Co	2,612,364
	Tube still heater	Universal Oil Products Co	2,613,654
	Heater for granular solids	Socony-Vacuum Oil Co	2,613,924
	High temperature fluid heater	Combustion Engineering-Superheater, Inc	2,614,541
	Condenser	Engineering Controls, Inc	2,614,816
	Pebble heater	Phillips Petroleum Co	2,614,823
	Pebble heat exchanger	Phillips Petroleum Co	2,614,824
	Pebble heater for converting hydrocarbons	Phillips Petroleum Co	2,614,968
Instrumentation	Fluid flow orifice	James H. Carbone	2,614,423
	Pneumatic apparatus for measuring fluid pressure	Builders Iron Foundry	2,614,424
	Velocity measurement of a moving fluid	Alfred J. Amsler & Co	2,614,425
	Liquid level gage	Westinghouse Electric Co	2,614,426
	Liquid level indicator	Eastman Kodak Co.	2,614,427
	Psychrometer	Rudolf M. Braun	2,614,428
	Temperature indicator	Eastman Kodak Co.	2,614,430
	Mercurial minimum thermometer	James M. Brady	2,614,431
	Gravity meter	North American Geophysical Co	2,614,432
Magnetic Separation	Separation of magnetizable and non-magnetizable particles in slurries	Simon-Carves, Ltd	2,612,262
Mixing	Rotary mixer for liquids	De Laval Separator Co	2,612,354
Polymerization	Continuous polymerizing reactors	Union Carbide & Carbon Corp	2,614,910
Solid-Gas Separation	Polyethylene air filter	Wingfoot Corp	2,612,966
	Bag-type dust collector	Pangborn Corp	2,612,236
	Electrical precipitator	Research Corp	2,614,652
	Recovery of solid particles from gases	Socony-Vacuum Oil Co	2,614,653
Solid-Liquid Separation	Froth breaker for thickeners	Vincent C. Lorenz	2,613,810
	Continuous gravity settler	Standard Oil Development Co	2,613,811
	Flotation apparatus	Resurrection Mining Co	2,614,821
	Centrifuge for separating solids	Howard P. Rusch	2,614,748

. . . And New Process Patents

Product or Process . . .	About . . .	Inventor or Assignee . . .	Patent No. .
Alcohol-aldehyde solutions	Extractive distillation	Standard Oil Development Co	2,614,970
Alcohols	Dehydration of alcohols	M. W. Kellogg Co	2,615,010
Alkylates for detergents	Polymerization of olefins	Standard Oil Development Co	2,612,531
Aromatic hydrocarbons	Purification of crystals	Standard Oil Development Co	2,614,134
	Extraction with thio-sulfonic acid esters	Standard Oil (Indiana)	2,615,057
Butadiene	Inhibiting polymerization during fractionation	Phillips Petroleum Co	2,613,175
Chlorinated acetaldehydes	Production	Food Machinery & Chemical Corp	2,615,048
Continuous carbonization	Maintaining fluidization	Standard Oil Development Co	2,614,069
CO and H_2	Synthesis of hydrocarbons in a fluidized bed	Phillips Petroleum Co	2,612,512
CO_2 and H_2S	Separation	Fish Engineering Corp	2,613,132
	Separation	Koppers Co.	2,614,904
Detergents	Neutralization	Purex Corp	2,613,218
Diallyl phthalate	Concentration of partial polymer	Shell Development Co	2,613,201
Ethanol-n Propanol	Separation by extractive distillation	Standard Oil Development Co	2,612,467
Fertilizers	Ammoniation in manufacture	Manufacturers de Produits Chimiques du Nord Etablissements Kuhlmann	2,614,040
Finely-divided silica	Production	Montclair Research Corp. and Ellis-Foster Co	2,614,096
Finely-divided sulphur	Production	Phillips Petroleum Co	2,614,908
Fouled catalyst	Stripping with steam	Sinclair Refining Co	2,613,173
Furfural	Recovery	Sun Oil Co	2,613,174
Gaseous hydrocarbons	Recovery	National Tank Co	2,614,658
Granular silicon carbide	Manufacture	Carborundum Co	2,614,946
Glyceride oil	Refining in paraffinic solvent with alcoholic metal hydroxide	Phillips Petroleum Co	2,614,111
Heavy petroleum oils	Hydrogenation	Union Oil Co	2,614,067
Hydrocarbon oil	HF treatment	Standard Oil (Indiana)	2,612,464
Hydrocarbons	Production of unsaturated hydrocarbons	Phillips Petroleum Co	2,613,233
	Hydrodesulphurization	Gulf Oil Corp	2,614,033
	Hydrodesulphurization	Gulf Oil Corp	2,614,066
	Synthesis in fluidized bed	Standard Oil Development Co	2,614,114
	Solvent extraction with fluorinated aliphatic carboxylic acids	Phillips Petroleum Co	2,614,965
	Multistage process for condensing products	Standard Oil Development Co	2,614,115
HF-hydrocarbon complexes	Recovery of drying oils from HF-hydrocarbon complexes	Pan American Refining Corp	2,164,132
Isoprene	Separation from other diolefins	Standard Oil Development Co	2,614,969
Latex	Recovery of rubber-like polymer from latex	Phillips Petroleum Co	2,615,000
Methallyl chloride	Production	Shell Development Co	2,612,530
Oil and wax	Separation by filtration	Texaco Development Co	2,612,465
Oily waste water	Treatment by adsorption	Infilco, Inc	2,613,181
Olefins	Polymerization with P_2O_5 trialkyl phosphate catalyst	Standard Oil Development Co	2,614,136
	Production of olefin polymers	Universal Oil Products Co	2,614,137
Organic compounds	Synthesis	M. W. Kellogg Co	2,615,035

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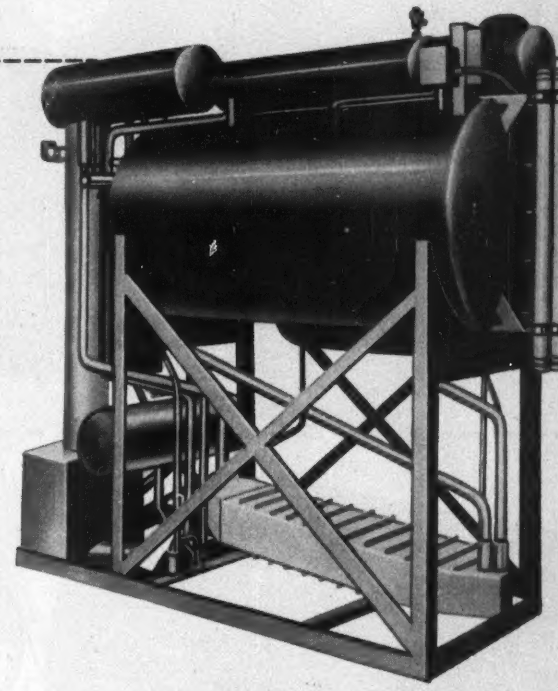

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The adaptable Servel 25-ton Water Chiller—operating on any source of steam—uses water as the refrigerant to provide economical temperature and humidity control in large buildings and factories. No expensive duct systems are required!

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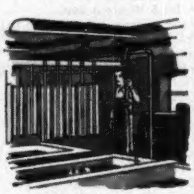


Because it operates with no moving parts on the time-proved absorption refrigeration principle, you can depend upon the Servel 25-ton Water Chiller for continuous high-efficiency cooling of liquids for various manufacturing and formulating processes.

3. INDUSTRIAL PRECOOLING

You can use the unusually flexible Servel 25-ton Water Chiller to precool air for increased capacity and improved performance of air compressors and internal combustion machines. The Water Chiller also serves other money-saving precooling purposes.

5-YEAR WARRANTY! Every Servel 25-ton Water Chiller is backed by a full 5-year warranty. Because it has no moving parts, the Servel Water Chiller operates quietly and without vibration. Add to these advantages its extremely compact size and light floor weight and you'll appreciate why it can be installed on any floor with most economical piping arrangement. May be installed singly or in multiple as required. Mail the coupon below today for complete information.

Servel

the name to watch for great advances in . .

AIR CONDITIONING ✓ REFRIGERATION

MAIL THIS COUPON TODAY

SERVEL, INC., Dept. CE-1, Evansville 20, Indiana

Please send me further information about application flexibility of the Servel 25-ton Water Chiller.

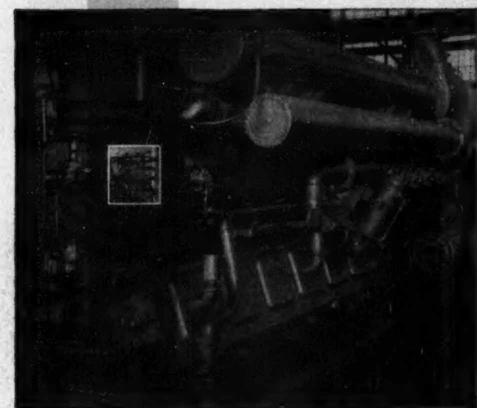
Name____________________

Firm____________________

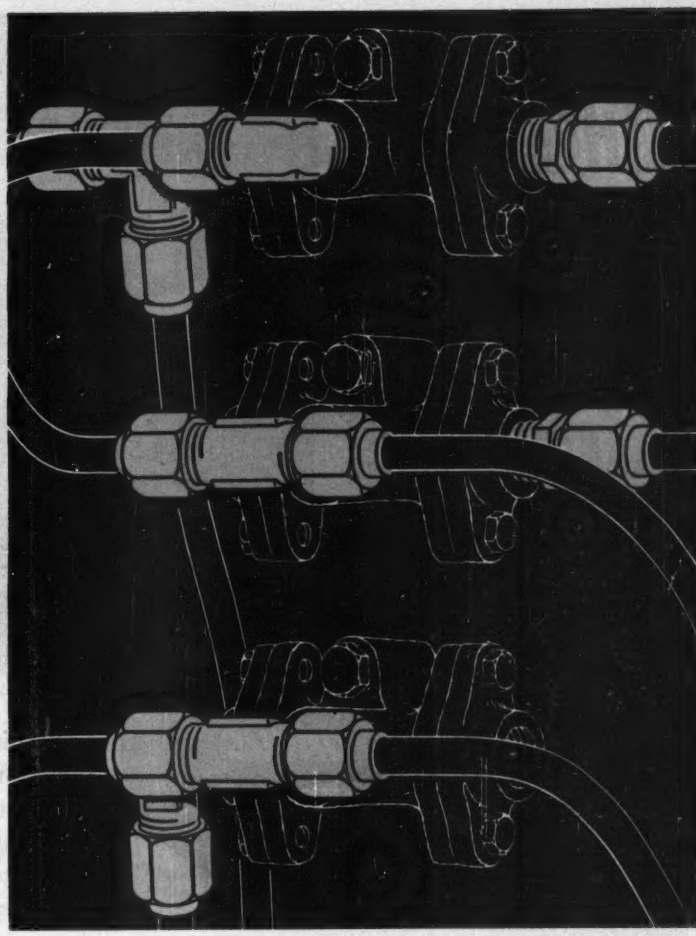
Address____________________

City__________ Zone___ State________

ON DIESEL ENGINES



This typical Diesel engine manufactured by The National Supply Company, Engine Division, Springfield, is equipped with Parker Triple-lok Fittings.



Tube it up...Forget it ...WITH PARKER

TROUBLE-FREE TRIPLE-LOK FITTINGS

Diesel service is rugged. Constant vibration puts a severe strain on all engine parts, including fittings connecting fluid handling lines. Yet no leak, however small, can be tolerated.

That's why so many Diesel engine manufacturers rely on Parker Triple-lok Fittings . . . the fitting that meets specifications of the A.S.M.E. Code for Pressure Piping, and J.I.C. and S.A.E. standards. They are leakproof under severest conditions of vibration, elevated temperatures, high pressures and repeated assembly.

So *tube it up* and *forget it* . . . with Parker Triple-lok Fittings. Ask your Parker Distributor for Tube Fitting Catalog 4300, or write The PARKER Appliance Company, 17325 Euclid Ave., Cleveland 12, O.

This does it

Triple-lok . . . 3-piece flare fitting famous for its sleeve . . . the easiest way to install tubing systems. Made in brass, steel, stainless steel, aluminum alloy.

Precision Mark of

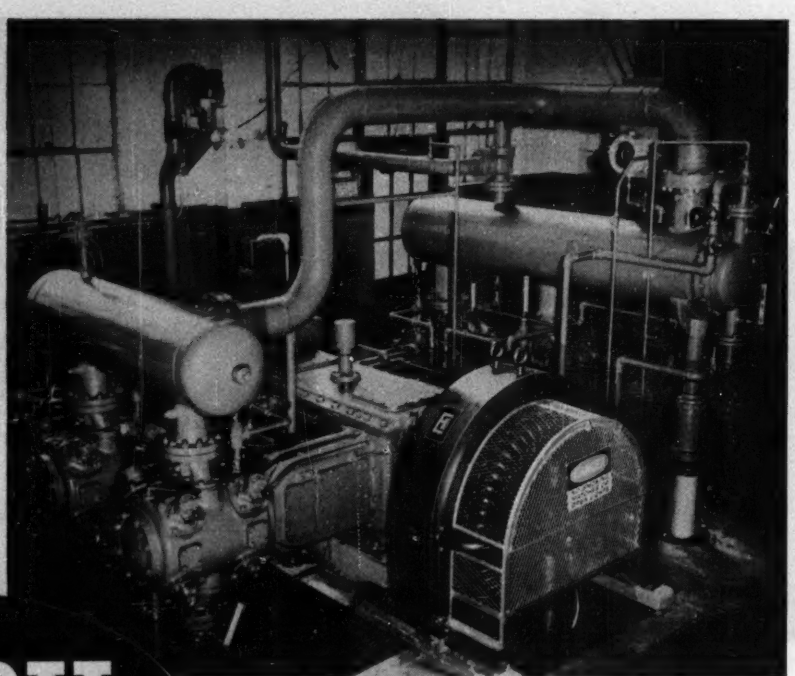
Leakproof Tube Fittings

Parker

TUBE FITTINGS • VALVES • O-RINGS

Plants in Cleveland • Los Angeles • Eaton, Ohio • Berea, Ky.

THE IDEAL DRIVE FOR GAS COMPRESSORS

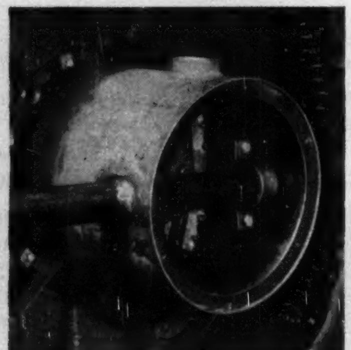


ELLIOTT *Synchronous* MOTORS

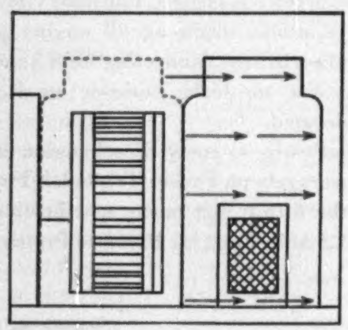
This Elliott synchronous motor drives a Clark CMA-4 compressor. It is featured by the rigidity and strength of its Elliott "Fabri-Steel" construction in frame and stator core plus a number of unique design and construction advantages.

ONE OF MANY REASONS FOR ELLIOTT RELIABILITY Starting winding bars are SILVER-BRAZED to heavy end ring segments, insuring a permanent, high strength joint, with highest electrical and thermal conductivity. Photo illustrates how an assembly jig is used during silver-brazing to guarantee accurate alignment of parts.

Long-wearing steel collector rings are completely enclosed and pressure ventilated with uncontaminated air. A transparent removable window permits inspection or quick replacement of brushes.



The overhung motor rotor reduces space requirements, eliminates need of an outboard bearing, and increases efficiency. Inspection of the entire stator core and field poles is simple, since the frame can be shifted along its foundation to clear the rotor.



ELLIOTT Company

DEPT. CE

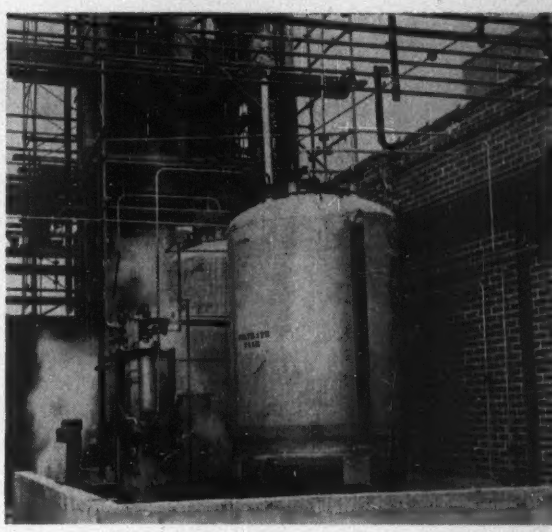
R2-1

Ridgway Division
RIDGWAY, PA.

Plants at: JEANNETTE, PA. • RIDGWAY, PA. AMPERE, N. J. • SPRINGFIELD, O. • NEWARK, N. J.
DISTRICT OFFICES IN PRINCIPAL CITIES

The *Speedline* system saves money on stainless piping and increases flow and capacity

You can save money on your corrosion-resistant piping systems . . . perhaps even cut your costs in half. *Speedline* engineers have achieved these amazing results by using the new light wall stainless pipe and versatile *Speedline* Fittings. Here's the way it works:



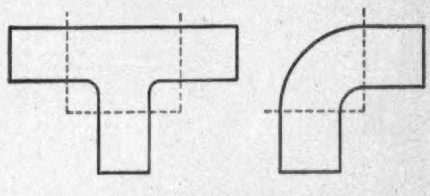
Over 800 *Speedline* flanges are used in this installation by one of the largest chemical producers. Shortly after they were installed, a mishap occurred which caused the fluid to solidify in the lines, building up tremendous pressures. When the lines were put back into operation, not a single *Speedline* flange leaked!

If you are now using Stainless Pipe . . .

. . . chances are that it is the conventional Schedule 40. But this heavy wall is not needed in 90% of the cases. Light wall Schedule 5 pipe costs about half as much, and all sizes will easily withstand 150 p.s.i. working pressures. *Speedline* Fittings are specially designed for fast, low-cost installation of light wall stainless pipe lines. And because light wall pipe of the same size has a larger inside diameter than heavy pipe, you gain 15% to 25% greater flow and capacity!

If you are now using Stainless Tubing . . .

. . . the *Speedline* system offers real savings and advantages. It permits you to change to a light wall *pipe* rather than *tubing* size—at no increase in cost. And here's where you gain. Standard equipment like valves, pumps, sight gauges, etc., are made in *pipe* sizes—you hook right in without special adapters! And equally important, *piping* permits you to use the next lower dimension (for example, 1½" pipe has essentially the same capacity as 2" O.D. tube). This means that you can use smaller valves, flanges, and other accessories—an entire installation would be considerably lower in cost.



Look for the "Tangential Feature"

These drawings show a *Speedline* Tee and 90° Elbow. The dotted lines show the termination points of conventional fittings. The additional straight section of *Speedline* Fittings permits attaching of unions or flanges without fouling, reduces the number of welds required, and eliminates troublesome curved or angle joints. The tangential feature is common to all *Speedline* Fittings such as Ells, Tees, Crosses, etc.

WRITE FOR THIS FREE BOOK

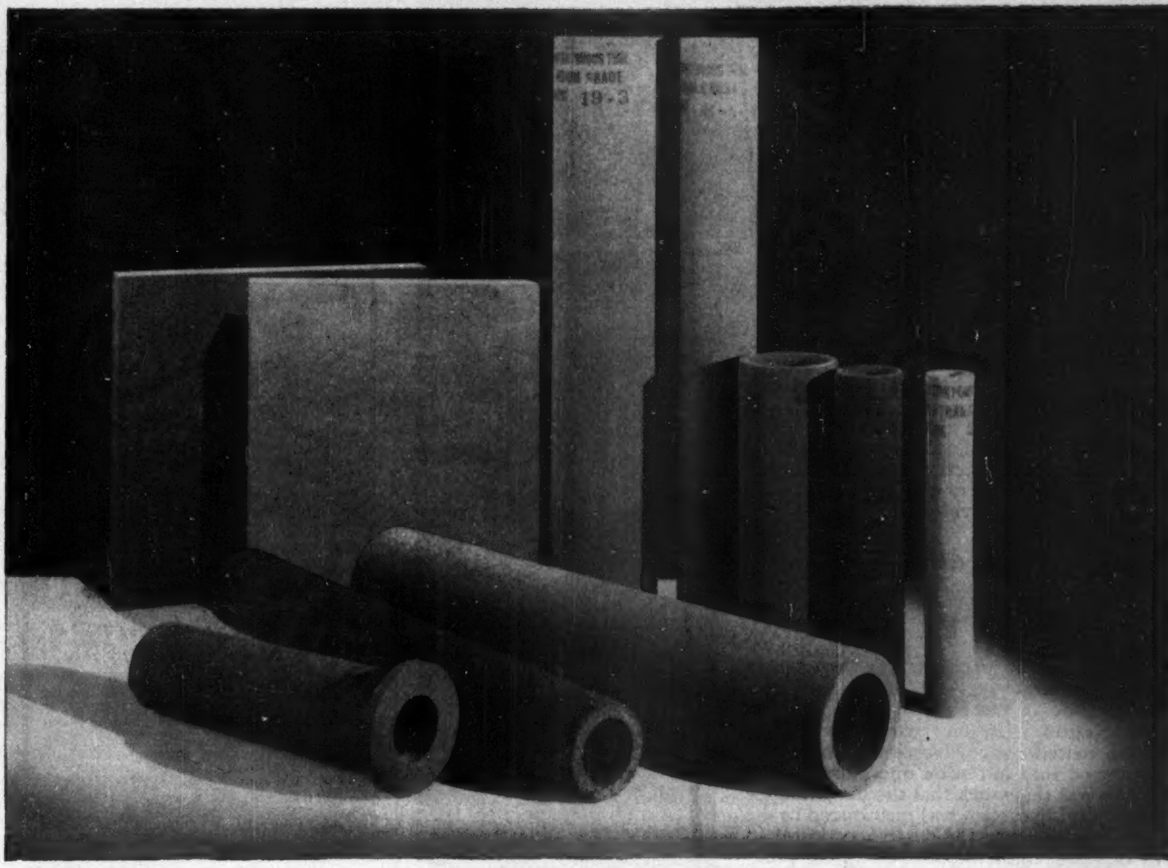
Just write a note on your company letterhead and we will mail the *Speedline* catalog to you. It shows why you get better results at less cost with *Speedline* Fittings.

Speedline distributors are located in principal cities from coast to coast

Speedline **Corrosion-Resistant FITTINGS**

—the newest thing in pipeline economy

Manufactured by **HORACE T. POTTS CO.** • Erie Avenue & D Street • Philadelphia 34, Penna.



For greater filtration efficiency, easier cleaning operation . . .

Norton ALUNDUM Seamless Tubes*

Increase the efficiency of your filtration system with Norton porous seamless tubes. Made of long lasting ALUNDUM grain, their seamless construction assures more uniform filtration and faster, more thorough cleaning by backwashing.

Used in systems filtering water, solvents, cutting oils, wine, food oils, and other liquids . . . in reclaiming cleaning fluids, industrial waste . . . in swimming pool filtration, and boiler feed water treatment.

Norton porous mediums, in both tube and plate forms, bring you chemical stability unaffected by most corrosive acids, strength that assures maximum resistance to breakage and chipping . . . controlled structure (an exclusive Norton process) that permits *positive* control over grain spacing and predetermined pore size and open pore ratio to meet your requirements.

Send for Bulletin No. 140

Plan now to get complete data on these Norton refractory products by obtaining Norton Bulletin No. 140: "Norton Porous Mediums." Ask your Norton representative for a copy or write us direct. NORTON COMPANY, 500 New Bond St., Worcester 6, Mass. *Canadian Representative:* A. P. Green Fire Brick Co., Ltd., Toronto, Ontario.

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

NORTON

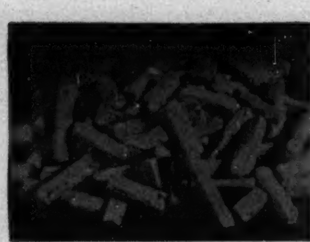
POROUS MEDIUMS

Making better products to make other products better

NORTON COMPANY, WORCESTER 6, MASSACHUSETTS

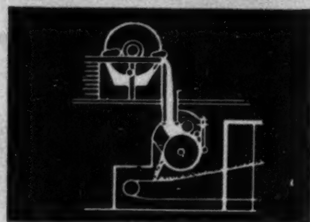
PROBLEM:

To dry CALCIUM CARBONATE, a wet-solid, quickly, and increase the output, yet control the uniformity and quality of the finished product.



SOLUTION:

By combining the principle of a Proctor preforming feed and a continuous conveyor dryer, Proctor engineers recommended a system that obtained the results required. On a Proctor fin drum feed, material was discharged to the conveyor in the form of small sticks. Heated air circulated through the bed of the material on the conveyor, resulted in rapid, uniform, through drying. Speed of production was increased and quality of finished product was accurately controlled.



Another processing problem solved by

PROCTOR INTEGRATED ENGINEERING

This processing problem was solved only by painstaking research. Exhaustive test work done in the Proctor laboratory, in cooperation with the customer's technicians, netted conclusive results that were projected into full scale operation. So accurate was this work that the performance of the drying system was guaranteed in the sales contract and the dryer was designed to dovetail right into the complete processing line. This approach to a processing problem is INTEGRATED ENGINEERING AT WORK!

By INTEGRATED ENGINEERING

we mean simply this—

1. Sales engineers are available for consultation.
2. A completely equipped experimental laboratory is available for test work at no cost or obligation.
3. Engineering background and experience in drying equipment and its relation to associated processing equipment in the range.
4. Close cooperation between Proctor engineers and the customer's technicians to bring about the solution to processing problems.

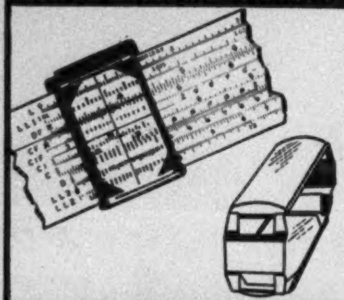
NOW PROCTOR IS PREPARED TO ENGINEER AND MANUFACTURE RELATED EQUIPMENT

With their long background in designing and building precision drying machinery, Proctor engineers have acquired a wide knowledge of processing equipment requirements ... so that today Proctor & Schwartz actually offers a complete engineering-manufacturing facility ready to help you consider not only your drying equipment needs—but a complete range of related processing equipment.

What is your processing machinery problem? Let Proctor INTEGRATED ENGINEERING help speed your solution.

PROCTOR & SCHWARTZ ·INC·
711 TABOR ROAD
Philadelphia 20, Pa.

SLIDE RULE USERS!



INSURE ACCURA-SEE!

P. E. G. Duplex Magnifier, with genuine precision-ground glass lenses, gives accurately-magnified readings on *both* faces of duplex rule, *without* having to remove and reverse magnifier. Folds to fit scratch-proof chamois case. Save your eyes! Send for your P. E. G. Duplex Magnifier today! Order by width of rule.

P.E.G. DUPLEX MAGNIFIER

Pocket slide rule size (magnifies 3X) 2.50

Standard rule sizes (magnify 2½X)

1 15/16 in.	order #1	3.50
1 5/8 in.	order #2	3.50
1 9/16 in.	order #3	3.50
1 3/8 in.	order #4	3.50

SEND CHECK OR MONEY ORDER TO MANUFACTURER'S REPRESENTATIVE:

FLATTO Mgt. Co.
70 W. 40 ST., N. Y. 18, N. Y.

DIFFERENTIAL PRESSURE CONTROL
FOR HIGH PRESSURES

Mercoid Type BB Differential Pressure Controls open or close a switch contact according to a change in the difference between two pressures.

Type BB employs two Bourdon tubes, each responsive to a pressure condition to operate a Mercoid Magnet operated mercury switch as the difference in pressure between them increases or decreases. Available in ranges 60 p.s.i. to 2,500 p.s.i.

Electrical Capacity—A. C. 115V., 5Amp., 230V., 2Amp., D. C. 115V., 2.5Amp., 230V., 1Amp.

WRITE FOR BULLETIN CA-6DP

THE MERCOID CORPORATION
BELMONT AVE CHICAGO ILL U S A

NO BREAKS WITH PENFLEX ON TANK SETTLEMENT

PENFLEX FLEXIBILITY
ALLOWS LINES TO WALK WITH TANK

Write for this helpful folder, "Flexineering" ... your guide to flexible tubing

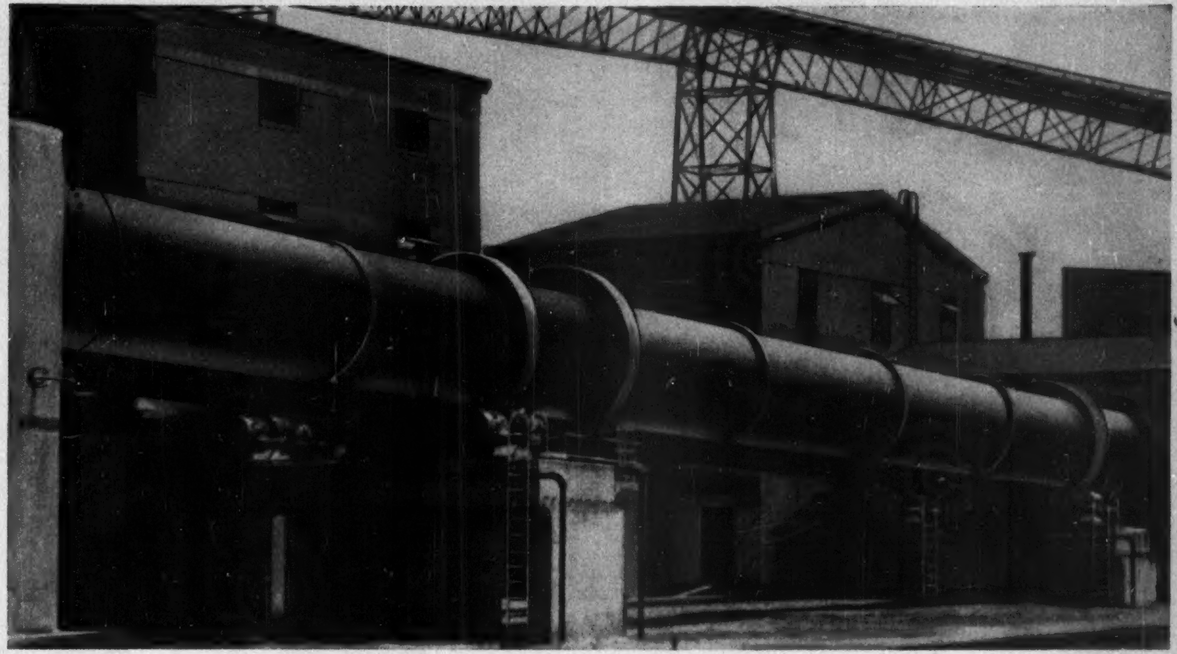
Heat . . . cold . . . tank settling . . . all made rigid pipe on oil storage tanks in a large New England bulk plant move, bend and break. Every break meant oil and gasoline lost . . . fire a constant threat.

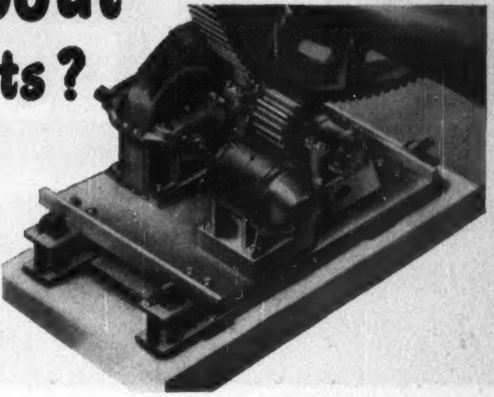
Then Penflex "Flexineering" solved the problem. Pipe breakage has been eliminated with a length of 12″ I.D. four-wall interlocked, specially packed Penflex tubing . . . installed with tight-packed flanges. Now any amount of thermal expansion or tank settling can occur with no leaks, breaks or spillage. Penflex tubing is tight as a pipe . . . yet flexible under all conditions.

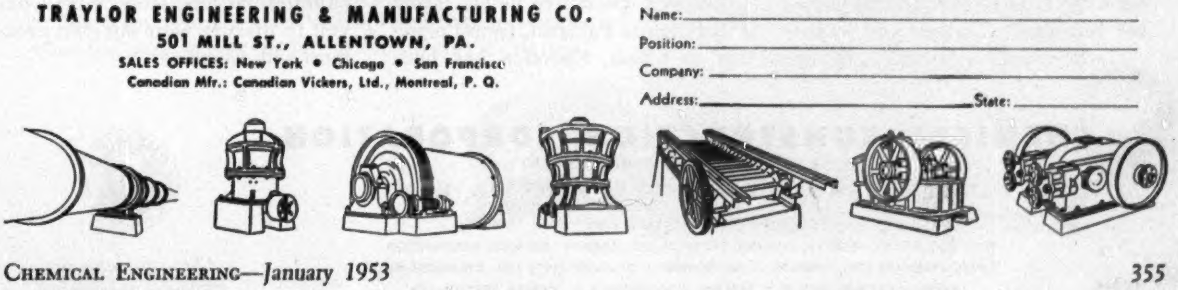
Let Penflex engineers help solve your tubing problems. Penflex manufactures a complete line of four-wall interlocked and seamless welded corrugated flexible tubing . . . metallic hose, tubing or couplings from 1/8″ I.D. and up . . . automatic barrel fillers, accessories and fittings.

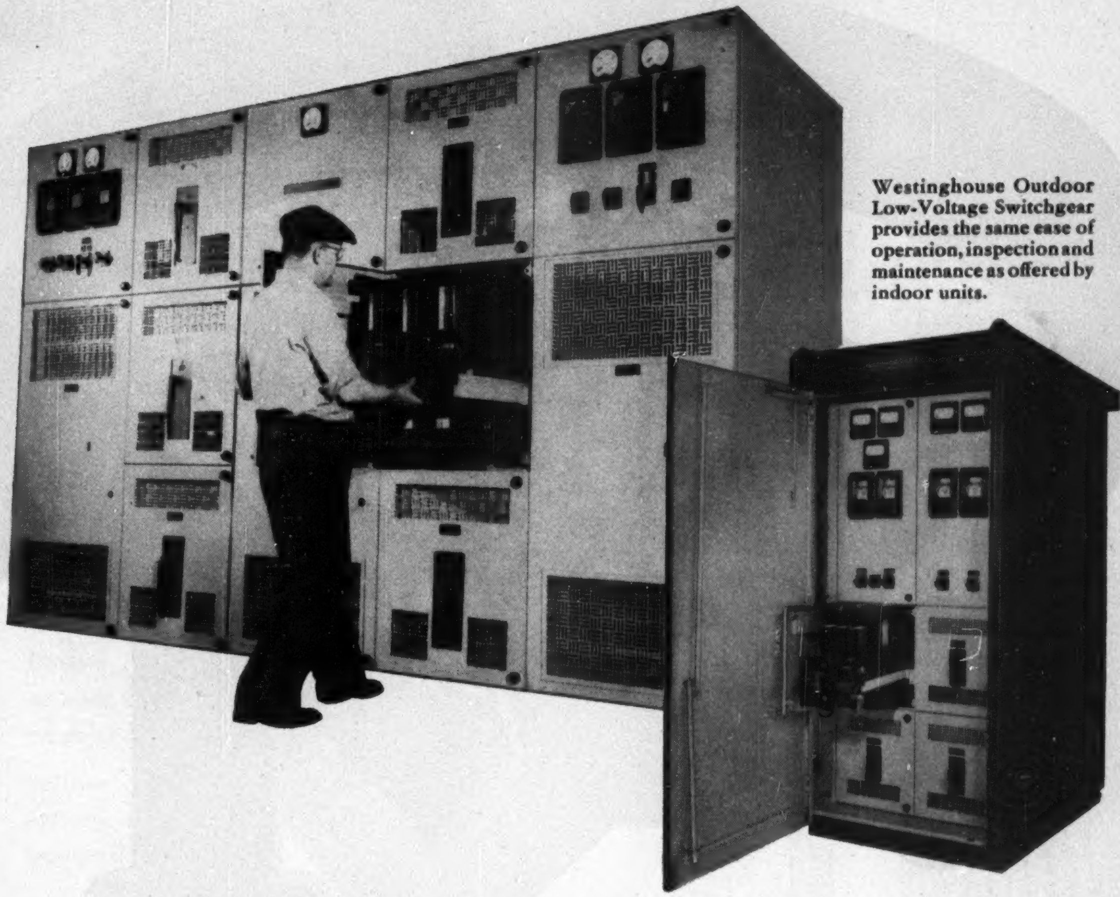
Pennsylvania Flexible Metallic Tubing Company, Inc., 7234 Powers Lane, Phila. 42, Pa.
Branch Sales Offices: **Boston • New York • Chicago • Houston • Cleveland • Los Angeles**

PENFLEX
HEART OF INDUSTRY'S LIFE LINES









Westinghouse Outdoor Low-Voltage Switchgear provides the same ease of operation, inspection and maintenance as offered by indoor units.

Now . . . flexible protection in less space

WITH WESTINGHOUSE LOW-VOLTAGE SWITCHGEAR

When you specify Westinghouse Low-Voltage Switchgear you get the most flexible low-voltage circuit protection available today. And you get it in compact, unitized enclosures that save valuable plant space . . . save you considerable planning expense . . . can be installed in a matter of hours.

An unusual degree of flexibility results from the modern selective tripping feature of the DB De-ion® Breaker. In a single, compact device, you get the perfect co-ordination of time-delay characteristics, which confines outages to the faulted section alone, to assure maximum continuity of service.

The Westinghouse Low-Voltage Switchgear design provides easy access to all components . . . simple drawout breaker operation . . . a complete metal enclosure for safety. It is available for circuits up to 600 volts, 15,000 to 100,000 amperes interrupting duty, for indoor or outdoor service.

For complete information on Westinghouse Low-Voltage Switchgear, write for Booklet B-5282. Address: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60794

DESIGN TESTED AND VERIFIED in the Westinghouse HIGH POWER LABORATORY

YOU CAN BE SURE... IF IT'S Westinghouse

LOW-VOLTAGE SWITCHGEAR

It's the Nash!

The ability of Nash Compressors to maintain original performance over long periods is no accident. Nash Compressors have but a single moving element, the Nash Rotor. This rotor is precision balanced for long bearing life, and it revolves in the pump casing without metallic contact. Internal lubrication, frequent cause of gas contamination, is not employed in a Nash. Yet, these simple pumps maintain 75 lbs. pressure in a single stage, and afford capacities to 6 million cu. ft. per day in a single compact structure.

Nash Compressors have no valves, gears, pistons, sliding vanes or other enemies of long life. Compression is secured by an entirely different principle of operation, which offers important advantages often the answer to gas handling problems difficult with ordinary equipment.

Nash Compressors are compact and save space. They run without vibration, and compression is without pulsation. Because there are no internal wearing parts, maintenance is low. Service is assured by a nation-wide network of Engineering Service offices. Write for bulletins now.

No internal wearing parts.

No valves, pistons, or vanes.

No internal lubrication.

Low maintenance cost.

Saves floor space.

Desired delivery temperature Automatically maintained.

Slugs of liquid entering pump will do no harm.

75 pounds in a single stage.

NASH ENGINEERING COMPANY
312 WILSON, SO. NORWALK, CONN.

yes WOLVERINE TRUFIN*

is available also

in ALUMINUM

Efficient . . . economical . . . compact . . . light-weight—four valuable assets in any heat-transfer application. Aluminum Trufin meets *all* these requirements.

Because of its integral fin construction—Trufin can withstand extreme temperatures and severe vibration without affecting heat-transfer efficiency.

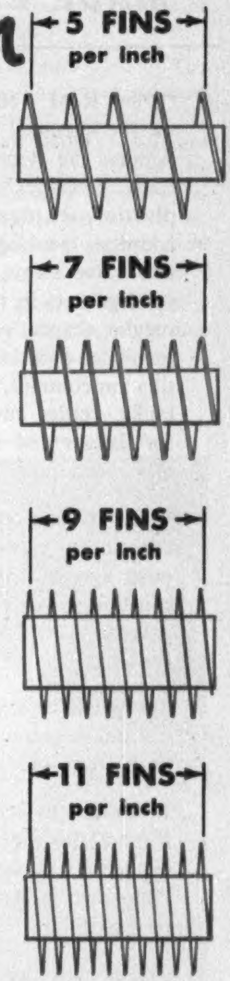
Actual applications have revealed that the heat-transfer efficiency of Trufin is sometimes *nine times* greater than plain tube! In many instances the use of Wolverine Trufin has resulted in low-cost installation and maintenance with maximum heat-transfer efficiency.

Aluminum Trufin is light; it's durable; and it's as easy to fabricate as plain tube!

Aluminum Trufin is available in hard or soft tempers; and in a variety of sizes—with inside diameters ranging from 5/16" to 1".

Send for your copy of Wolverine's Bulletin dealing with Trufin and heat-transfer.

in



WOLVERINE TUBE DIVISION
Calumet and Hecla Consolidated Copper Company
INCORPORATED
Manufacturers of tubing exclusively
1427 CENTRAL AVE. DETROIT 9, MICH.

Wolverine Trufin and the Wolverine Spun End Process available in Canada through the Unifin Tube Co., London, Ontario.

*REG. U. S. PAT. OFF.

Wolverine manufactures Trufin condenser tubes in copper and copper base alloys and bi-metal in a variety of fin spacings and fin heights. —also plain condenser tubes in copper and copper base alloys.

PLANTS IN DETROIT, MICHIGAN AND DECATUR, ALABAMA
Sales Offices in Principal Cities

Export Department, 13 E. 40th St., New York 16, N. Y.

A WIDE RANGE OF

R/M Teflon* PACKINGS

MADE ESPECIALLY FOR THE CHEMICAL INDUSTRY

The R/M Teflon Packing line for the chemical industry is complete. Among the items included are solid rings, Vee-Flex® rings, braided and plastic packings, solid spacers and adapters, packings for stuffing boxes and valve stems, "envelope" gaskets, solid gaskets in round, square and irregular shapes, gaskets for handholes, manholes and flanges, gaskets for distillation columns, gaskets for covers on tanks, kettles and autoclaves, gaskets for flanges and nozzles on glass and glass-lined pipe.

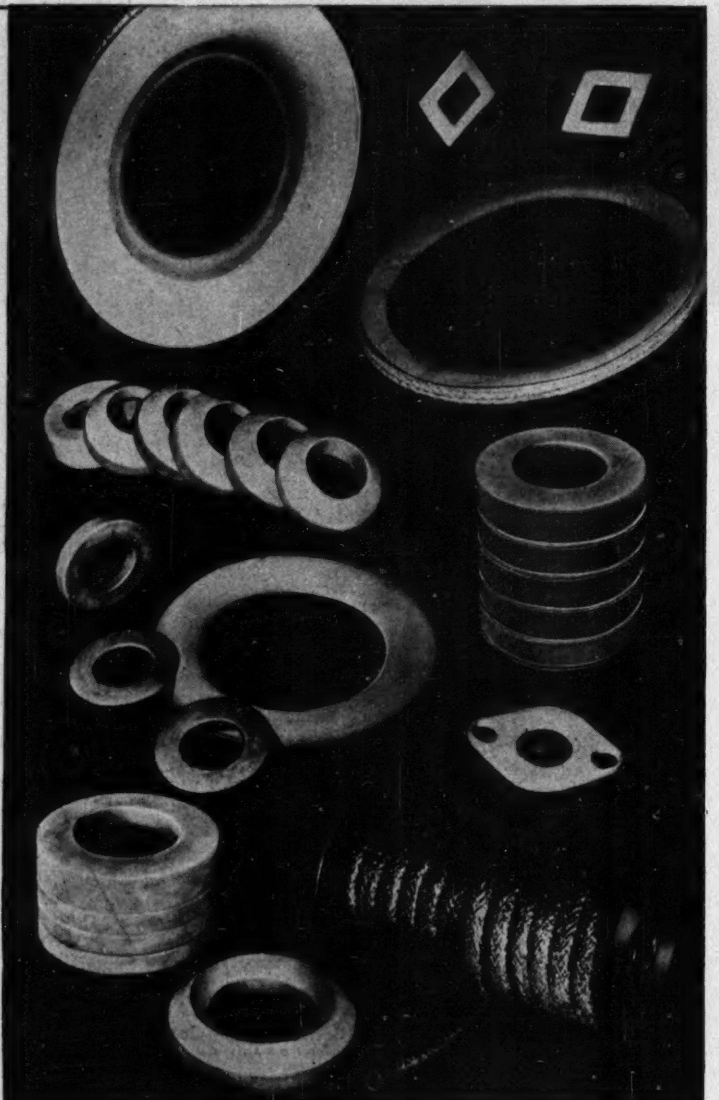
Wherever you are using stainless steel equipment, glass piping, porcelain or other special materials to resist acids, caustics, solvents and other chemicals, you can make good use of R/M Teflon Packings.

Teflon can be kept in continuous service and is recommended for temperatures from −80°F. to 500°F.

In addition to the packings listed above, R/M Teflon tubes, rods and sheets are available for those companies that cut their own gaskets or fabricate their own parts.

Teflon may be the answer to your problems. Write for recommendations.

**Du Pont trade-mark for its tetrafluoroethylene resin*

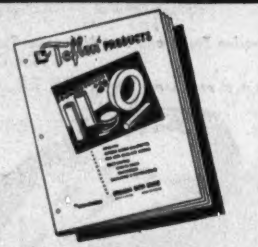


R/M PACKINGS

RAYBESTOS-MANHATTAN, INC.
PACKING DIVISION, MANHEIM, PA.

FACTORIES: Bridgeport, Conn.; Crawfordsville, Ind.; Manheim, Pa.; No. Charleston, S.C.; Passaic, N.J.; Peterborough, Ontario, Canada

RAYBESTOS-MANHATTAN, INC., Manufacturers of Mechanical Packings • Asbestos Textiles • Industrial Rubber Products
Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings • Fan Belts
Radiator Hose • Sintered Metal Products • Bowling Balls



Write today for free copy of catalog on R/M Teflon Products

What tube steel gives you the best life/cost ratio? Ask the experts!

This month's report is on: **2% CR.-MO.**

Has intermediate corrosion resistance in combination with good creep strength and fair resistance to oxidation. For use at temperatures up to 1200° F. in cracking coils, reforming units, heat exchangers, vapor line and hot oil piping, and return-bend forgings for oil heaters.

23 TIMKEN® STEELS FOR HIGH TEMPERATURE SERVICE

Carbon	Sicromo 2	Sicromo 5S	16-13-3*
Carbon-Mo.	Sicromo 2½	Sicromo 5MS	25-20*
DM-2	2¼% Cr.-1% Mo.	Sicromo 7	25-12*
Silmo	Sicromo 3	Sicromo 9M	35-15*
DM	4-6% Cr.-Mo.	18-8 Stainless	16-25-6*
2% Cr.-Mo.	4-6% Cr.-Mo.-TI.	18-8 Cb	

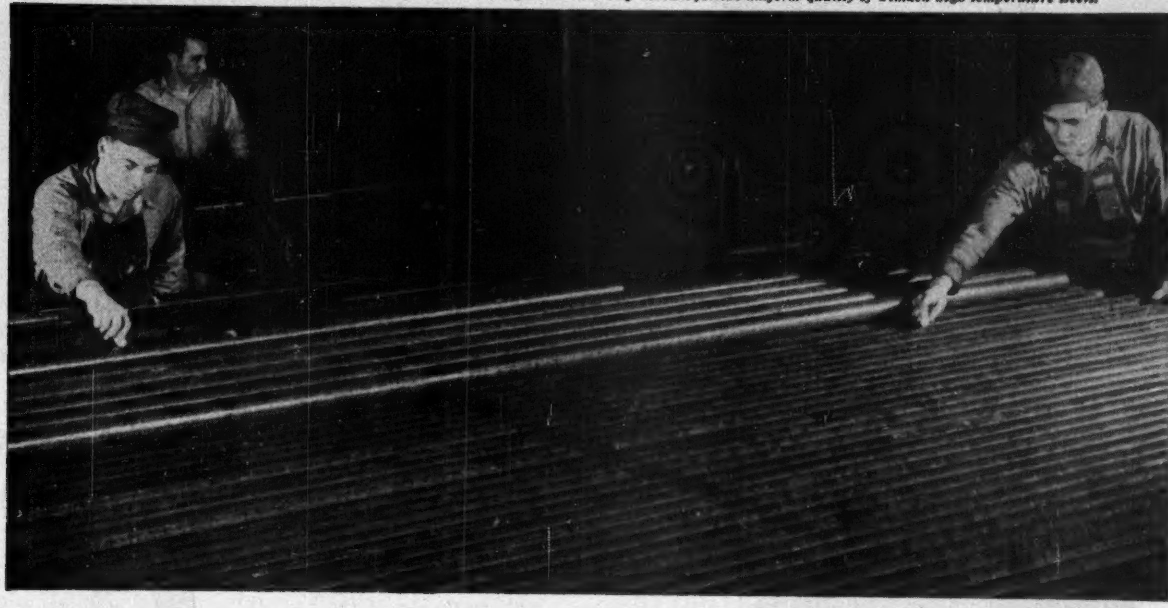
**Not available as seamless tubing at the present time.*

MAYBE you can find several high temperature tube steels that will solve your particular set of heat, pressure, corrosion and oxidation problems. But there's only *one* steel that will give you maximum tube life per dollar—the best life/cost ratio.

To find that one steel, go to the metallurgists of The Timken Roller Bearing Company. They're recognized authorities on high temperature steels. Backed by 20 years' experience and research and with 23 different analyses at their disposal, they'll help you choose the one best steel for your application. And you'll be assured of uniform quality in every tube because of the Timken Company's rigid quality control from melt shop through final inspection.

Our "RSQ"—Research, Supply, Quality—can solve your tube problems. *Ask the experts!* The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

Photo below shows final tube inspection—last of hundreds of rigid tests that help account for the uniform quality of Timken high temperature steels.



YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

SAFE SURE FAST EASY

VALVE OPERATION

Get all 4 with LIMITORQUE

For remote or local control . . . positive, speedy, safe, dependable opening and closing of all types of valves up to 120" diameter . . . equip with Limitorque. *Just pushing a button sets them in operation.*

They provide complete safety in two ways: First, they protect the workmen by eliminating the need of climbing to high or hazardous locations for manual valve operation. Second, they protect the valve operating parts by assuring a tight valve closure without overload on disc, seating rings or valve stems . . . and by automatically shutting-off the motor if foreign obstructions are met during the closing cycle.

Limitorque is actuated by any available power source . . . electricity, air, water, gas or oil.

Your valve maker can supply Limitorque Controls.

For complete details about Limitorque, send for Catalog L-50.

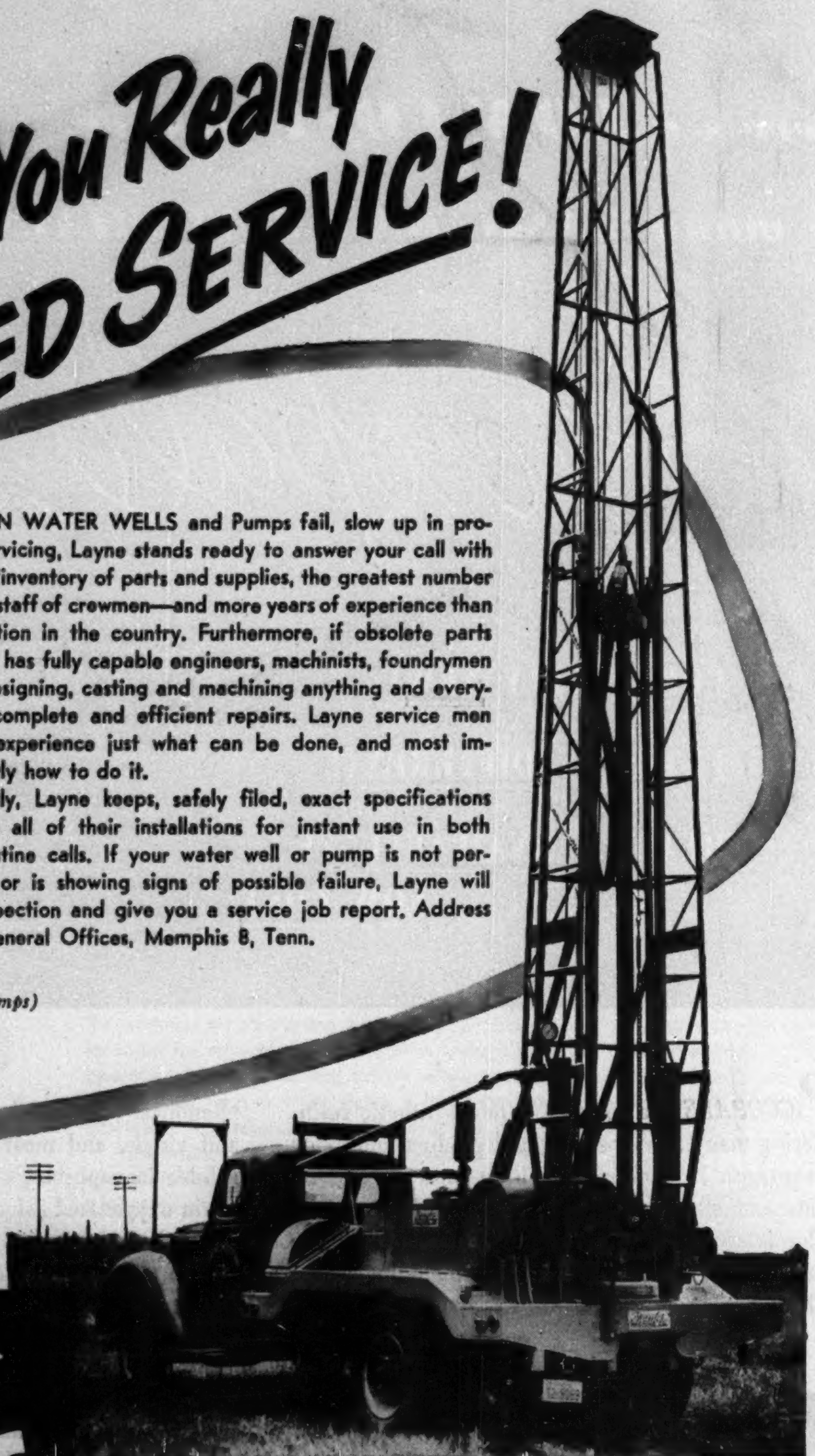
Philadelphia Gear Works, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

NEW YORK · PITTSBURGH · CHICAGO · HOUSTON · LYNCHBURG, VA.

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

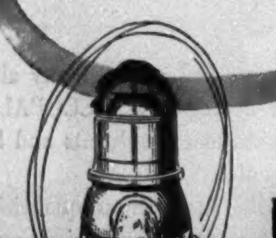
When You Really NEED SERVICE!



WHEN WATER WELLS and Pumps fail, slow up in production or need servicing, Layne stands ready to answer your call with the world's largest *inventory of parts and supplies, the greatest number of rigs, the biggest staff of crewmen—and more years of experience than any other organization in the country. Furthermore, if obsolete parts are required, Layne has fully capable engineers, machinists, foundrymen and factories for designing, casting and machining anything and everything needed for complete and efficient repairs. Layne service men know from actual experience just what can be done, and most important of all, exactly how to do it.

Advisedly, Layne keeps, safely filed, exact specifications and full details on all of their installations for instant use in both emergency and routine calls. If your water well or pump is not performing efficiently or is showing signs of possible failure, Layne will gladly make an inspection and give you a service job report. Address Layne & Bowler, General Offices, Memphis 8, Tenn.

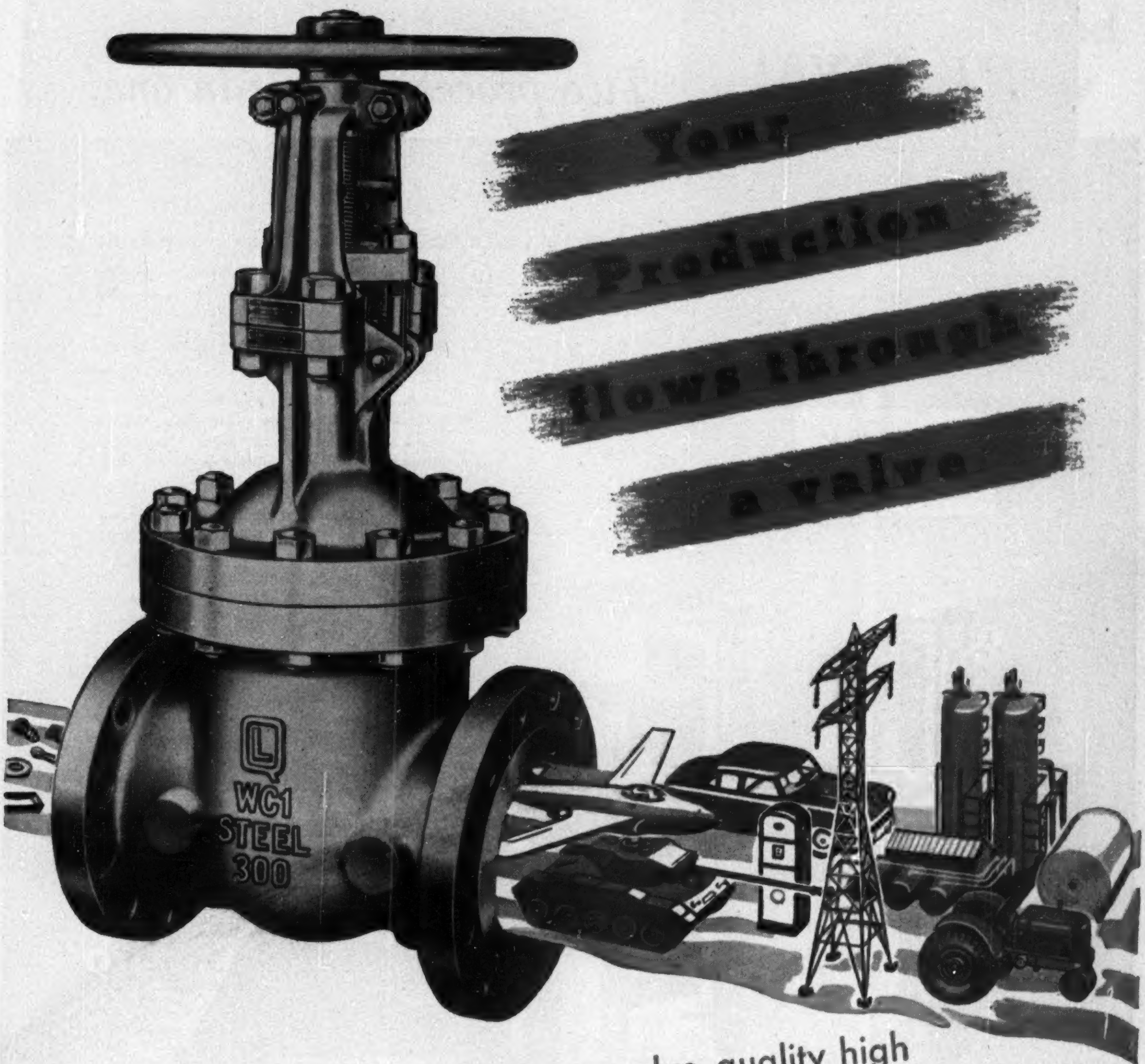
*(*for all makes of pumps)*



Layne

WATER WELLS

VERTICAL TURBINE PUMPS—WATER TREATMENT



To keep production moving, keep valve quality high

FIG. 123
N·M·D
(Non-Metallic-Disc)
BRONZE VALVE

Correctly engineered for long life in handling steam, hot water, cold water, air and gas, oil, gasoline, butane, propane.

Any plant, regardless of type or size, uses valves—bronze, iron, or steel. Industry relies on Lunkenheimer Valves that stay on the job, year-in, year-out . . . helping sustain continuous peak production. And that's why Lunkenheimer quality is so essential today.

Industry's faith in Lunkenheimer Valves is based on nearly a hundred years of experience with Lunkenheimer design, materials, and workmanship.

BRONZE • IRON • STEEL

LUNKENHEIMER

THE ONE *Great* NAME IN VALVES

L-152-26

DE LAVAL
CP PROCESS PUMPS

Two process pumps in one!

Look at these design extras

(1) Choice of open or closed impellers.

(2) Choice of flexible packing or mechanical seals.

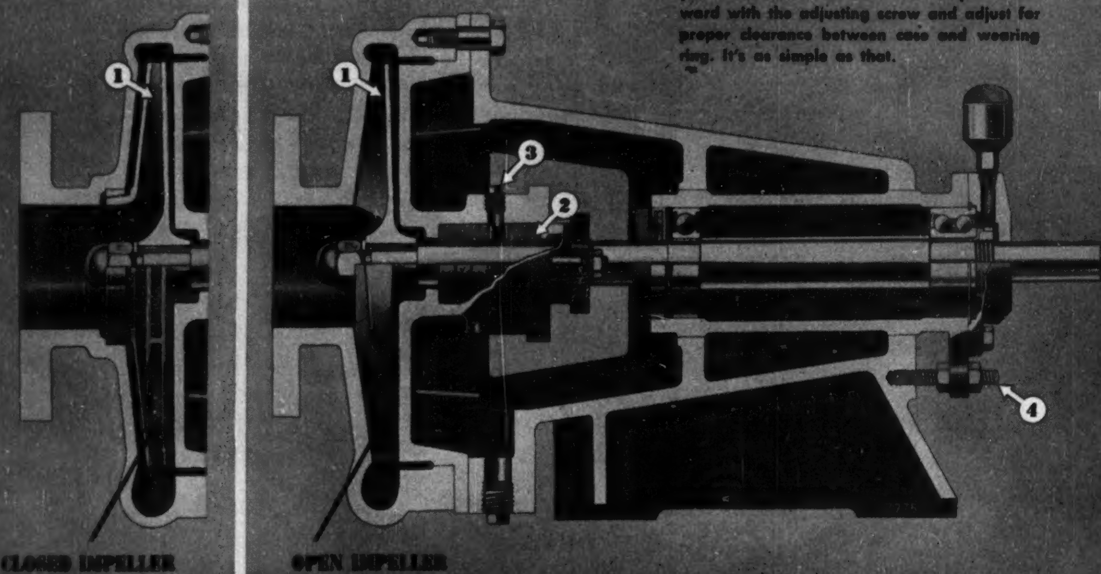
(3) Inlet-outlet water seal connections provide sealing liquid and cooling for mechanical seals.

(4) Entire rotor can be adjusted axially by external adjusting screw.

When wear occurs on impeller face or case of open impeller pumps, simply face off worn parts, re-assemble and adjust to proper clearance with the adjusting screw. No shims needed—no fussy fits.

On closed impeller pumps the tapered wearing ring does the job. When wear occurs all you do is move the rotor and impeller forward with the adjusting screw and adjust for proper clearance between case and wearing ring. It's as simple as that.

SIZES TO 6"
CAPACITIES TO 1800 GPM
HEADS TO 200'



Let this two-in-one construction trim your pumping costs. If service requirements change, De Laval CP pumps can be quickly converted from closed to open impeller (or vice versa) by simply changing the pump volute and impeller. *There's no need to buy a whole new pump.*

CP pumps can be quickly changed from flexible packing to mechanical seals too. Gland faces are pre-machined and drilled to make it an easy job.

Whatever your processing application . . . whether you want to pump hot or cold clear liquids, viscous liquids, corrosive liquids or those carrying suspended solids . . . these versatile two-in-one CP pumps can meet changing requirements in your plant. Bulletin 1125 tells fully why they are . . . DESIGNED TO STAY ON THE LINE.

DE LAVAL *Process Pumps*

DE LAVAL STEAM TURBINE COMPANY
803 Nottingham Way, Trenton 2, New Jersey

DL-187


A STEAM TRAP CASTS A
BIG effects from little traps! And, the effects are multiplied by the number of traps in the plant you design or operate until they grow to be a *major* influence upon operating efficiency and economy. Before you specify steam traps ask your nearby Armstrong Representative to call. He is qualified to give you practical assistance and answers that can save you a lot of time and trouble.
THINGS STEAM TRAPS AFFECT
1. HEAT-UP OR START-UP TIME
2. RATE OF PRODUCTION
3. STEAM WASTE
4. FUEL WASTE
5. CONTINUITY OF OPERATION
6. MAINTENANCE COST
Cast semi-steel side inlet — side outlet series. ½", ¾" and 1" pipe connections.
Cast semi-steel bottom inlet — top outlet series. ½" through 2" pipe connections.
ARMSTRONG STEAM TRAPS
ARMSTRONG MACHINE WORKS
858 Maple St., Three Rivers, Michigan
It Pays to Specify
ARMSTRONG

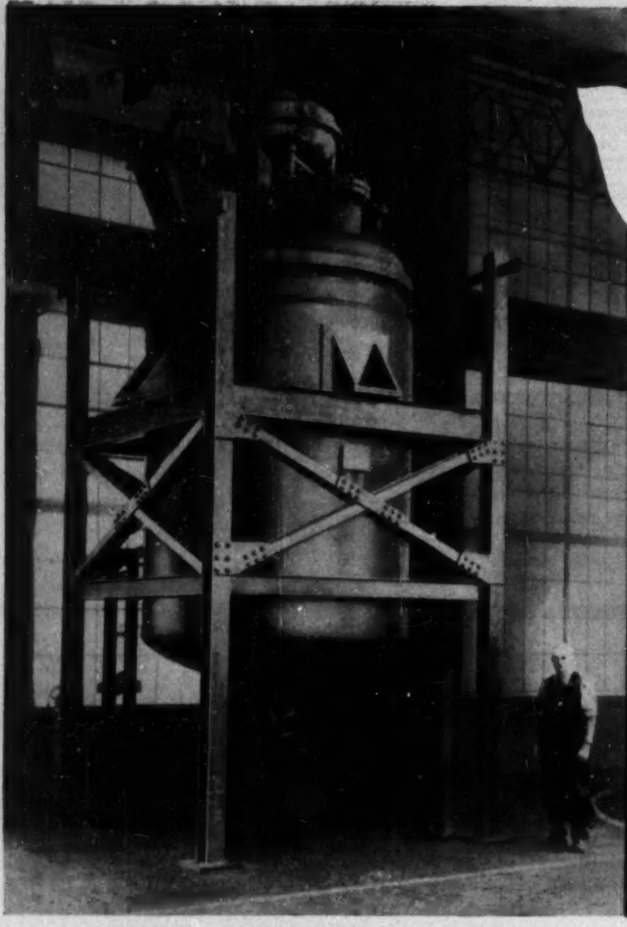
MIGHTY BIG SHADOW

REASON	HOW ARMSTRONG TRAPS MEET THE NEED	EXAMPLE
When steam is turned on, large amounts of condensate *and air* must be removed before equipment heats up.	Condensate *and air* removed as fast as they reach trap. Reliable data insures you get trap with adequate safety factor to meet conditions.	*40 Minute Faster Heat-up*—drying oven at pharmaceutical plant heats up 40 minutes sooner with Armstrong "Blast" traps.
Quick heat-up, maximum temperatures essential for maximum output.	Air which reduces temperature and heat transfer discharged automatically; condensate discharged at steam temperature; equipment kept *full* of hot, dry steam.	*30% Greater Output* — jacketed kettles produce 30% more at Canadian plant since changing to Armstrong traps.
When steam gets past traps, boiler capacity may be inadequate—this is bad even if you could afford the fuel waste.	When steam floats the bucket the trap closes. No steam ever reaches discharge orifice, even when there is no condensate load. Heat treated chrome steel valve parts, precision ground and lapped, resist wire drawing and wear, stay leak tight for a long, long time.	*Steam Savings Eliminate Need for New Boiler*—chemical plant shelves plans to buy larger boiler after installing Armstrong Traps.
Why burn fuel to generate steam that does no useful work . . . blows through traps, for example?		*33⅓% Reduction in Fuel Bill* — after trapping vats with Armstrongs at Missouri plant.
When traps are inoperative or down for repairs, unit being drained may be "off the line."	Nothing to clog, seize, stick or collapse! Large orifice. Self-scrubbing action cleans out ordinary dirt and scale. "Frictionless" leverage with wear points heavily reinforced for long life. Hardened chrome steel valve and seat. Wear and corrosion-resistant stainless trim.	*Maintenance Time Cut 30%* — Illinois user says, "Unequalled dependability, simplicity of design means repairs can be made quickly" (with minimum equipment downtime).
Traps that don't "wear well" take a lot of manhours for repair.		*50% Less Trap Maintenance* — only half as many manhours devoted to traps since installing Armstrongs throughout large Midwestern plant.

SEND FOR THE *NEW* ARMSTRONG STEAM TRAP BOOK

Fresh off the press — 44 pages of practical trapping data. Tells how to select traps for nearly every class of equipment; explains safety factors; gives prices, physical data, service pressure ratings of Armstrong traps; includes recommended installation, maintenance and trouble-shooting practice; contains many time-saving charts and tables — condensing rates, trap capacities, trap size recommendations and others. For your free copy, call your local Armstrong Representative or write to Armstrong.

STEAM TRAPS



BUFLOVAK Steam Jacketed Kettle, 2750 gals. Speeds the production of a high quality grease for a nationally-known company.

A very vital step in processing *

DO YOU . . .

want to save time?

cut costs?

make better products?

* Buflovak Kettles available in our Research Laboratories to test new processes . . . new products!

New and untried processes frequently present unexpected problems. The safest procedure is to process a quantity of the product and observe the results. Such facilities are available in the BUFLOVAK Research and Testing Laboratory. Results show *positively* what is needed for your processing. Kettles can then be designed and built to most economically and profitably fulfill your expected requirements.

Free! **48-PAGE COLOR BOOKLET**

. . . So detailed it is literally a handbook on Heating . . . Cooling . . . Drying, etc.

You *can* save time, cut costs, and make better products, by using BUFLOVAK Kettles in your processing. BUFLOVAK Kettles have proved to be a vital part in processing operations . . . and operations can be progressively performed in the same unit, thus speeding up production, lowering investment costs, and increasing profits.

BUFLOVAK Kettles perform a number of very basic operations: heating, cooling, mixing, extracting, reacting, distilling, evaporating, drying, and solvent recovery. Vacuum, atmospheric, or pressure operations can be provided.

Kettle sizes range from the one gallon laboratory size to massive units. Illustrated above is a 2750-gal. kettle.

Positive mixing and thorough cleaning of the heating surface is provided by eight distinct types of agitators with modifications to meet the individual need.

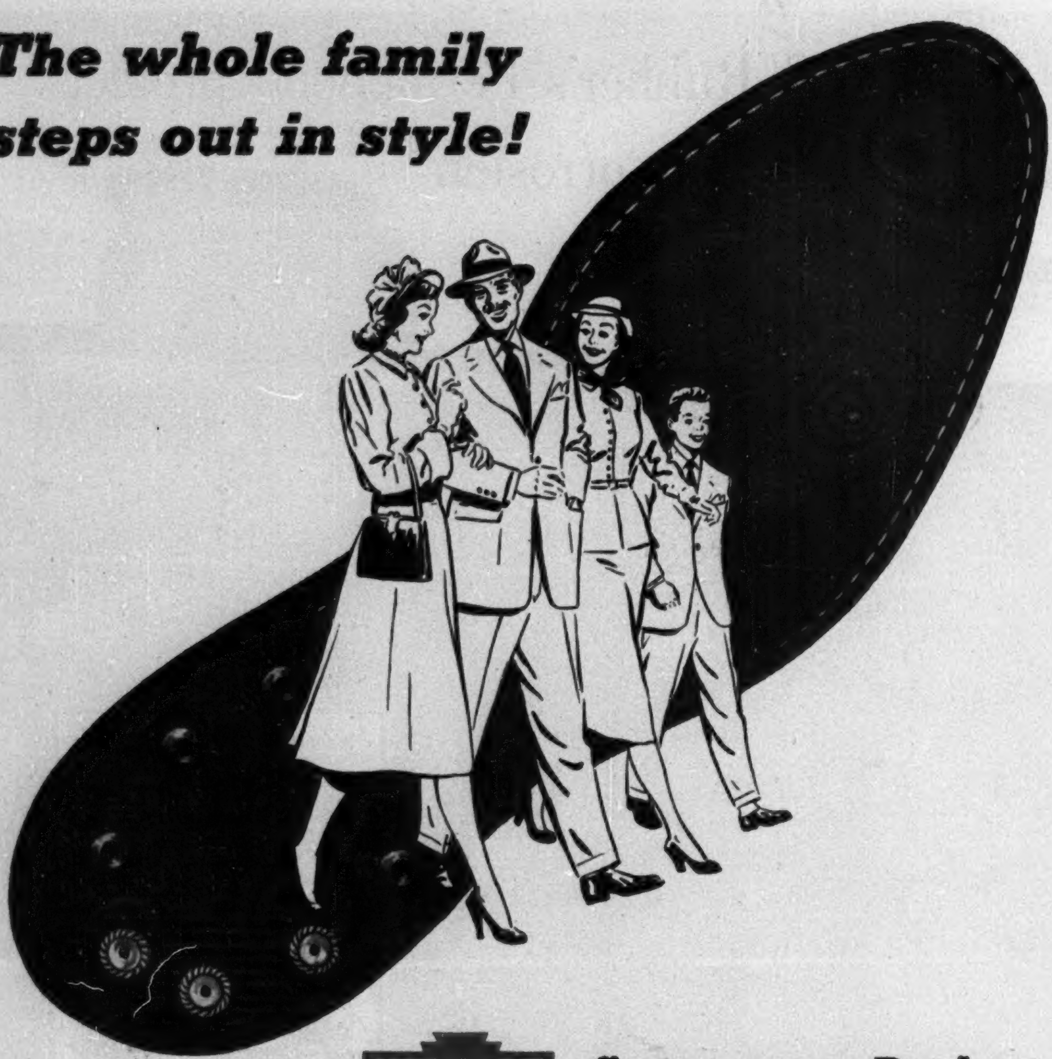
Yes, you will profit, as are so many varied industries today, by specifying BUFLOVAK Processing Kettles.

BUFLOVAK EQUIPMENT

Division of Blaw-Knox

1551 FILLMORE AVE., BUFFALO 11, N.Y.

The whole family steps out in style!



... thanks to NEVILLE Coumarone Resins

Why not call on Neville's years of experience and "know-how" to help you in your particular problems.

• PRODUCTS OF TOMORROW FROM THE CHEMICALS OF TODAY

The buyer of shoes looks for style, lightness, flexibility, comfort, waterproof protection and long wear!

The manufacturer, on the other hand, in order to guarantee these necessary selling points, seeks tensile strength, abrasion resistance, flex-life and uniform quality in the stock he uses for producing quality foot-wear!

That's why Neville Coumarone Resins are being used in sole and heel compounding in ever-increasing volume. Through them manufacturers enjoy improved properties and production advantages, building tack in their compounds without sacrificing hardness, tensile or tear.

THE NEVILLE COMPANY • PITTSBURGH 25, PA.

Plants at Neville Island, Pa., and Anaheim, Cal. C3

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U.S.I. CHEMICAL NEWS

★ A Series for Chemists and Executives of the Solvents and Chemical Consuming Industries ★

Season's Greetings
From
U.S.I. CHEMICAL NEWS
to its many readers,
contributors, and associates

Investigate Gas Leaks Through Metal, Glass

Scientists at an industrial research laboratory are currently engaged in a project involving gas leaks so infinitesimal it would take 10,000 years to empty the contents of a pint bottle, according to a recent report. Reason for the research is that hydrogen and other gases can seek their way through solid glass and metal at these slow rates, and the leaks are sufficient to ruin the high vacuums used in other work, it is said. For example, it was recently found that helium had leaked through the double walls of a vacuum space in a laboratory bottle. Later, when liquid nitrogen was placed in the bottle, the minute quantity of helium caused the nitrogen to boil away.

Investigations have revealed that gases differ in their ability to permeate various barriers. The very small permeation rates can be measured accurately by means of the mass spectrometer. Helium filters easily through glass and plastics, the report states, but fails to penetrate metals in any measurable quantities. Hydrogen, on the other hand, quickly invades metals as well as glass and plastics. Nitrogen penetrates steel but is effectively contained by copper, and oxygen slips through silver with comparative ease.

Tritium Plus Stilbene — Continuous Light Source

By incorporating tritium, super-heavy hydrogen from the Oak Ridge atomic reactor, into stilbene, a crystalline hydrocarbon compound, research workers have produced a material which acts as a substantially constant light source, it was disclosed recently. Explanation given for the phenomenon is that tritium continuously gives off beta rays which cause the stilbene to fluoresce. Because of this, the new crystals yield almost constant luminosity and yet have essentially no health hazards, it is claimed. Light from tritiated stilbene is visible to the eye, but the maximum light output is strongest in the region where the eye is least sensitive and where all phototubes are most sensitive. The new source is therefore expected to be useful in optical research and in calibrating instruments containing phototubes which have to be standardized periodically. Brightness of the crystals diminishes at the rate of about five per cent each year, whereas radium-activated sources of the type now used lose half their light in about three to six months, it is said.

U.S.I.'s Resin Line Is First To Cover Both Major Fields Of Decorative Wall Finishes

Tailor-Made Alkyds for Flat Wall Finishes, In Both Conventional and Odorless Solvents, And for Latex Paints Fill All Requirements

Visitors at U.S.I.'s booth at the Paint Industries' Show last month in Chicago saw an exhibit by the first single manufacturer to offer a line of alkyd resins

Making the job easier is one of U.S.I.'s chief aims in developing resins for the paint industry. For the manufacturer, this means alkyd resins that are easier to handle in any quantity. For the ultimate consumer, it means finishes that are easier to apply by either brush or roller.

which fill the requirements of both major classes of decorative wall finish manufacture. Now, whether a paint manufacturer's vote is for alkyds or for latex, or split between these two principal categories of decorative wall finishes, he can choose his resins for either type of product from U.S.I.'s complete line of raw materials for the paint industry.

U.S.I. makes no attempt to predict the relative positions that latex paints will take in the wall finishes market as compared to

MORE

Test New Safety Device For P., V., & L. Industry

Independent laboratory tests have reportedly confirmed the utility of a new tool for providing safe working conditions in the paint, varnish, and lacquer industry. The tool is a complete "pocket-laboratory" device, described as simple and economical to operate, which measures atmospheric concentrations of aromatic hydrocarbons in the range of their threshold limit values for safe 8-hour daily exposures. Principle of the device is based on a specific color reaction on a gel surface. To conduct a test, two reagents are mixed, tamped into a glass tube, and the tube inserted into a detector between the source of contaminated air and a squeeze bulb. The contents of the tube, initially white in color, turn brown only after exposure to benzene, toluene, or xylene. Concentrations are then read directly in parts per million by matching the length of brown stain in the tube with the proper scale placed beside it.

Tests using known concentrations of aromatic hydrocarbons gave good results with single compounds, somewhat higher than additive values for mixtures of two or more. The presence of masking deodorants and other organic vapors were found to cause no interference, according to the report.

Vitamin B_{12} Found Useful In Treating Polyneuritis

In their recent report on the use of vitamin B_{12} to treat patients with neurological disease, two French doctors have concluded that the vitamin has a positive action on early polyneuritis. In their tests, they were able to obtain noticeable improvement in 17 of 43 patients with multiple sclerosis of average intensity. Four of the patients were able to resume their normal occupations after years of illness and failure of all previous treatment. Functional improvement was obtained in eight patients with spastic paraplegia, and four patients who were formerly invalids were able to resume former activities after treatment. Results in seven cases of polyneuritis were described as spectacular, with three of the patients being cured within one week.

U.S.I. CHEMICAL NEWS

CONTINUED *Tailor-Made Alkyd Resins*

alkyd types. The company is proud, however, of the pioneering part it has played in regenerating a lagging consumer market with developments which have improved both classes of finishes.

AROFLATS Lead the Way

Alkyds evolved as vehicles for interior and exterior enamels during the 1940's, with temporary interruptions during the war because of critical raw material shortages. While consumers benefited from the improved qualities alkyds imparted to enamels, it was not until late 1949, with the introduction of U.S.I.'s AROFLAT 3010, that alkyds began to influence the largest volume class of interior paints — decorative and flat wall finishes. AROFLAT 3010 was the first pure alkyd, specifically designed as the sole vehicle for flat wall finishes, to be placed on the market. It met with rapid and wide acceptance in multiple coat systems, and was followed a few months later by AROFLAT 3025 — the first pure alkyd offered for use as the sole vehicle in self-sealing wall paints. U.S.I.'s alkyd vehicle line was completed a year later with the introduction of AROFLAT 3050, designed to meet demands for more economical alkyd flat paints of good quality.

AROPLAZ Resins and Latex

By the time latex paints appeared on the horizon as a promising innovation in the home decoration field, U.S.I. had already been the first to make alkyd vehicles available in odorless mineral spirits. Thus paint manufacturers were able to compete with the new threat to alkyds' supremacy from the start. At the same time, it was realized that latex paints were here to stay, and with several years background in emulsion research already behind them, U.S.I. laboratories soon introduced the first alkyd specially designed for latex paints — AROPLAZ 1274. This resin, when properly emulsified and mixed with latex, overcomes tendencies of pure latex toward poor adhesion and poor scrubability when wet. It also contributes better color retention, greater freeze-thaw stability and greater latitude of pigmentation — all at no increase in raw material costs of the finished paint.

New Ink Transfer Method Imprints Rubber, Plastics

The first successful one-operation process for transferring multi-colored printed impressions from paper to either rubber or plastics was announced in a recent report. Said to permit true reproduction of 300-screen half-tones in color, the new ink transfer process requires a separate printed label, on a type of paper similar to magazine stock, for each transfer. No special kind of printing ink is needed. The method is described as economical and rapid, and because a slight curing operation permanently seals the impression, the transferred image will last as long as the surface on which it is printed, it is claimed. Applications are foreseen in the imprinting of various sidewall color combinations on tires, patterns on plasticized vinyl chloride and other plastic products, and labelling on conveyor belting and rubber matting.

Pre-Mixed Reagent Tablets Save Time for Analysts

For the analytical chemist who determines total nitrogen by the old reliable Kjeldahl method, what is claimed to be a great time saver is now available in the form of compressed tablets containing the standard formulas for catalyzing digestion of organic matter. Now, instead of making the three weighings usually required and carefully washing down the neck of the flask afterwards, the analyst simply slides one or two tablets, depending on the method he is using, into the flask, and proceeds. The tablets are available in three formulations, each of which provides all the catalytic ingredients necessary for one determination according to procedures in general use. Chemicals used to make the tablets are precision weighed, ground, and blended in large quantities to insure uniformity, and are bound with a special material which does not affect the reaction, it is said.

TECHNICAL DEVELOPMENTS

Information about manufacturers of these items may be obtained by writing U. S. I.

Pressure-sensitive labels which require no licking, available in roll tape form in a hand dispenser, can be marked with pencil, pen, or typewriter, and adhere to "anything" under all laboratory conditions, it is claimed. **(No. 871)**

A magnetic door latch, suitable for any type of cabinet, has no working parts to wear out and is said to keep even sagging or warped doors firmly closed. **(No. 872)**

For coating or decorating polyethylene products, a new synthetic enamel is available, in a wide range of colors, which reportedly adheres well without peeling or chipping and can be brushed or sprayed. **(No. 873)**

New anti-rust paints, in black and clear, are claimed to absorb surface rust completely in their penetration process and to stop and prevent further rust — indoors or out — without prior scraping and wire-brushing. The clear paint can be painted over with other paints. **(No. 874)**

A new tarnish remover for silver, bronze, and copper has been announced. To clean, the article is immersed in the clear, non-poisonous liquid for about 10 seconds. No rubbing or scouring is needed, it is said. **(No. 875)**

Bacteria that break down masonry can be checked permanently, it is reported, with a new active germicide which is incorporated into cement. Product is recommended for plant use and for shower room floors. **(No. 876)**

To bond metals to themselves, other metals, ceramics, glass, or wood, a new bonding agent in rod, powder, paste, and liquid forms is claimed to bond by capillary and chemical action, to have high fluidity and wetting ability, and to penetrate all but sealed joints. **(No. 877)**

For reducing glare in factories, hospitals, etc., translucent and colored plastic sheeting is on the market which, when cut to windowpane size, can be adhered to the glass indefinitely by applying wet and squeegeeing out the water. Plastic can be stripped off easily when desired, it is said. **(No. 878)**

A new paint and varnish remover for metals is reported to be non-inflammable, to act rapidly so that residues can be washed off with water and the metal repainted immediately. **(No. 879)**

A portable magnesium ramp for loading and unloading freight cars from ground level where no docking facilities exist, is now available in 5 standard sizes ranging in capacity from 6,000 to 16,000 pounds. **(No. 880)**

PRODUCTS OF U.S.I.

ALCOHOLS
Amyl Alcohol (Isoamyl Alcohol)
Butanol (Normal-Butyl Alcohol)
Fusel Oil—Refined
Propanol (Normal-Propyl Alcohol)

Ethanol (Ethyl Alcohol)
Specially Denatured—all regular and anhydrous formulas
Completely Denatured—all regular and anhydrous formulas
Pure—190 proof U.S.P., Absolute—200 Proof
Solox*—proprietary solvent—regular and anhydrous

ANTI-FREEZE
Super Pyro* Anti-Freeze
U.S.I. Permanent Anti-Freeze

ETHERS
Ethyl Ether, U.S.P.
Ethyl Ether, Absolute—A.C.S.

ACETONE—A.C.S.

ANSOLS
Ansol* M
Ansol* PR

ACETIC ESTERS
Amyl Acetate—Commercial and High Test
Butyl Acetate
Ethyl Acetate—all grades
Normal-Propyl Acetate

OXALIC ESTERS
Dibutyl Oxalate
Diethyl Oxalate

PHTHALIC ESTERS
Diamyl Phthalate
Dibutyl Phthalate
Diethyl Phthalate

OTHER ESTERS
Diatol*
Diethyl Carbonate
Ethyl Chloroformate

RESINS (Synthetic and Natural)
Arochem*—modified types
Aredure*—urea-formaldehyde resins
Arofene*—pure phenolics
Aroflat*—for special flat finishes
Aroflint†—room temperature curing phenolic
Aroplaz*—alkyds and allied materials
Aropol†—copolymer modified alkyds
Ester Gums—all types
Natural Resins—all standard grades

INSECTICIDE MATERIALS
CPR Concentrates: Liquid & Dust
Piperonyl Butoxide
Piperonyl Cyclonene
Pyrenone* Concentrates: Liquid & Dust
Pyrethrum Products: Liquid & Dust
Rotenone Products: Liquid & Dust

INSECTIFUGE MATERIALS
Indalone*
Triple-Mix Repellents

INTERMEDIATES
Acetoacetanilide
Acetoacet-ortho-chloroanilide
Acetoacet-ortho-toluidide
Acetoacet-para-chloroanilide
Ethyl Acetoacetate
Ethyl Benzoylacetate
Ethyl Sodium Oxalacetate

FEED PRODUCTS
Calcium Pantothenate (Feed Grade)
Curbay B-G*
DL-Methionine (Feed Grade)
Niacin, U.S.P.
Riboflavin Concentrates
Special Liquid Curbay*
U.S.I. Vitamin B_{12} and Antibiotic Feed Supplements
Vacatone* 40

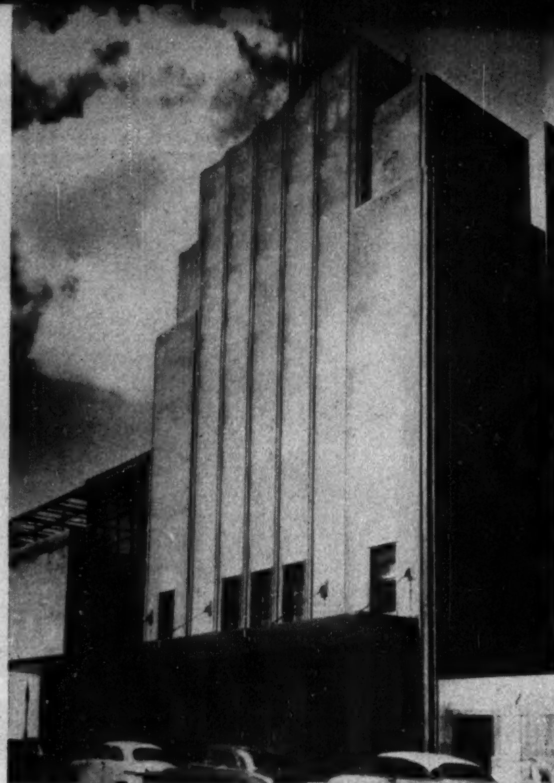
OTHER PRODUCTS
Collodions
Ethylene
Methionine (Pharm. Grade)
Nitrocellulose solns.
Propionic Acid
Pib*—Liquid Insulation
Urethan, U.S.P.
Acetaldehyde
Propionaldehyde

*Reg. U.S. Pat. Off.
†Trademark Pending

U.S. INDUSTRIAL CHEMICALS CO.
Division of National Distillers Products Corporation

120 BROADWAY, NEW YORK 5, N. Y. | BRANCHES IN ALL PRINCIPAL CITIES

TELEVISION POWER BREAKER. The 500-kva G-E unit substations at WWJ-TV have voltage ratings of 4800-208Y/120, are equipped with Type AK-1-25 air circuit breakers.



WWJ's NEW BUILDING houses studios of Detroit's pioneer TV station. General Electric load-center system furnishes power for amplifying, lighting—other station requirements.

Detroit's new TV studios rely on

Power continuity assured for all studio requirements at WWJ-TV by secondary-selective distribution system

For the engineers of WWJ-TV—Detroit's pioneer TV station and an affiliate of WWJ, the world's first commercial radio station—a dependable source of continuous power rates first consideration in planning the new television studios. Total or even partial power shutdown cannot be tolerated.

At its new studios, WWJ-TV needs reliable power for lighting and amplifying . . . for its monitor panels and relaying equipment . . . for all station auxiliaries such as fans and blowers. To assure reliable power continuity for these many exacting requirements, Giffels & Vallet, Inc., L. Rossetti, associated engineers and architects, and Jack A. Frost, electrical contractor, installed a G-E secondary-selective load-center system consisting of two 500-kva unit substations.

With this distribution system, the station gains, too, in savings basic to load-center power. For example, a G-E engineered load-center system maintains consistent voltage for top operating efficiency, keeps voltage drop down to a minimum, provides less costly feeder breakers, and reduces cable costs.

Air circuit breakers, with ratings properly coordinated with transformer capacities, give adequate interrupting capacity and isolate troubles in feeders. Oil fuse cutouts are interlocked to prevent opening with load on transformers.

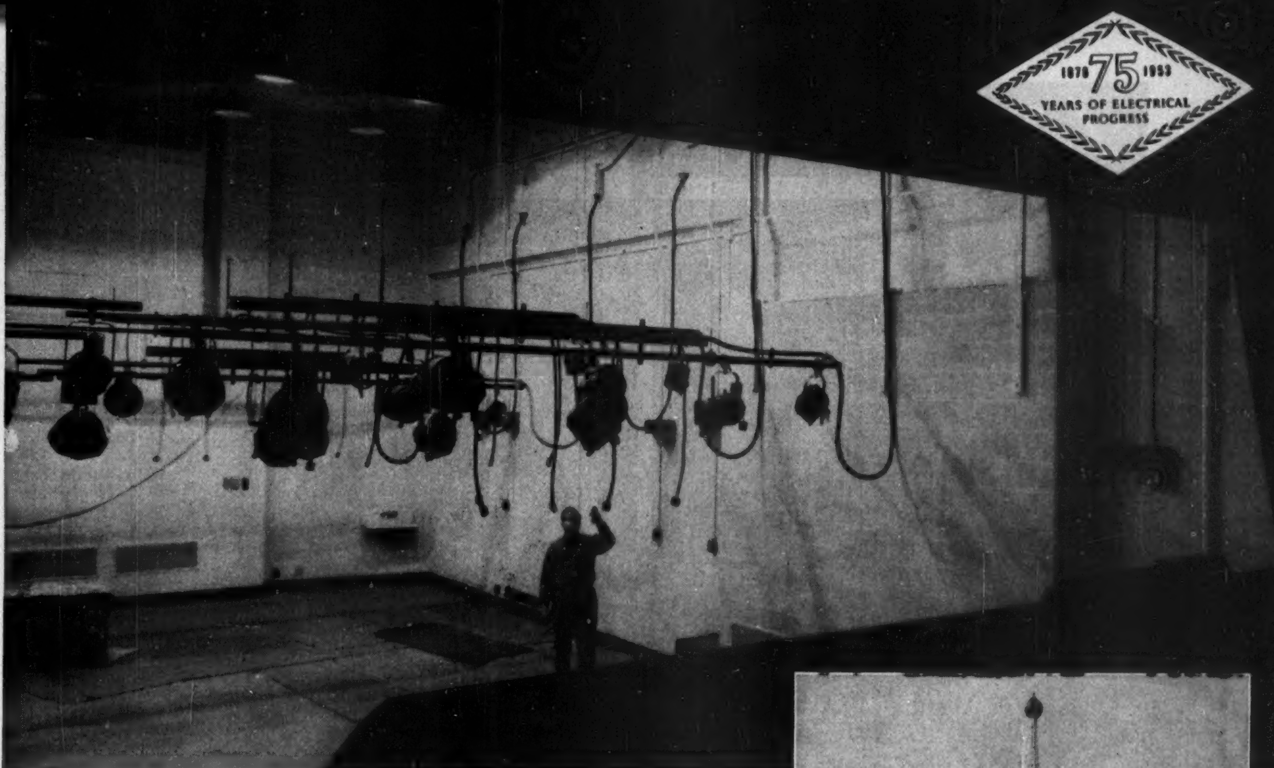
Flexible layout permits easy, quick maintenance without interruption of power. System flexibility itself provides for addition of new loads, making it far less costly for the station to expand in the future. Grounded, metal-enclosed G-E load-center units, with non-inflammable Pyranol* transformers assure maximum protection for operating personnel.

For further information on G-E engineered load centers, call your local G-E sales representative, or write for GEA-3592, General Electric Company, Schenectady 5, N. Y. 321-67

*Reg. Trademark of General Electric Co.

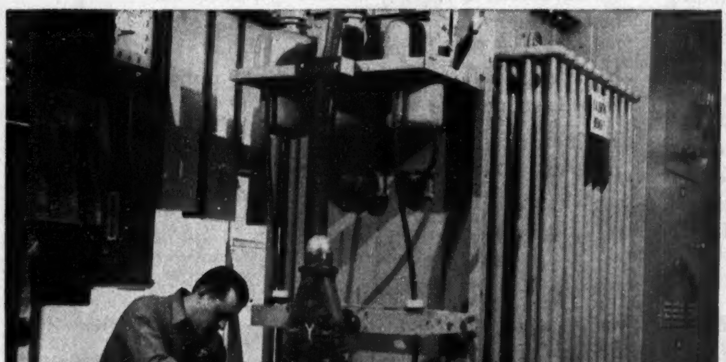
GENERAL ELECTRIC

1878 75 1953
YEARS OF ELECTRICAL PROGRESS



LIGHTS FOR TV PRODUCTION. Studio construction shot from WWJ-TV's control booth shows battery of lights necessary for televising. Lighting throughout the new station is fed from G-E engineered load centers.

G-E load-center system



CUTOUTS FOR PROTECTION. Engineer wires pothead of incoming high-voltage cable to cutouts on transformer of TV lighting breaker. Oil cutouts are interlocked, cannot be opened or closed with load on transformer.

PENOBSCOT BUILDING—Detroit's highest—houses all of WWJ-TV's transmitter equipment. TV antenna tops highest central portion. Here are transmitted programs originating in new studios powered by G-E load centers.

Cold for fatty acid crystals

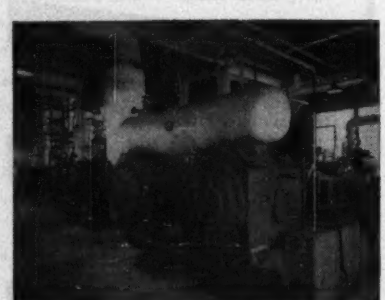
Solvent crystallization is one of the important processes at Armour and Company's new chemical plant at McCook, Ill. The process is used to separate acids that contain the same number of carbon atoms and cannot be separated by fractional distillation.

A vital part of this process is the Worthington refrigeration system consisting of two double-pipe stainless-steel chilling machines, a horizontal duplex two-stage ammonia compressor, horizontal duplex ammonia booster compressor, flu-gas compressor, and shell and tube equipment.

Armour is another in an ever-growing list of "big names" in the chemical industries who have chosen Worthington refrigeration. Others include: B. F. Goodrich Chemical Co., Avon Lake, Ohio; Dow Chemical Co., Freeport, Tex.; Minnesota Mining and Manufacturing Co., St. Paul, Minn.; Lion Chemical Co., El Dorado, Ark.; E. I. DuPont de Nemours & Co., Edgemore, Del., Orange, Tex.; Shell Chemical Co., Houston, Tex.; Gulf Oil Corp., Port Arthur, Tex; Rohm & Haas Co., Houston, Tex.

When these well-known companies look for refrigeration to be used in controlling a myriad of intricate reactions, they look for the best. Their choice is your best evidence that *there's more worth in Worthington.*

Worthington Corporation, Air Conditioning and Refrigeration Division, Harrison, N. J.

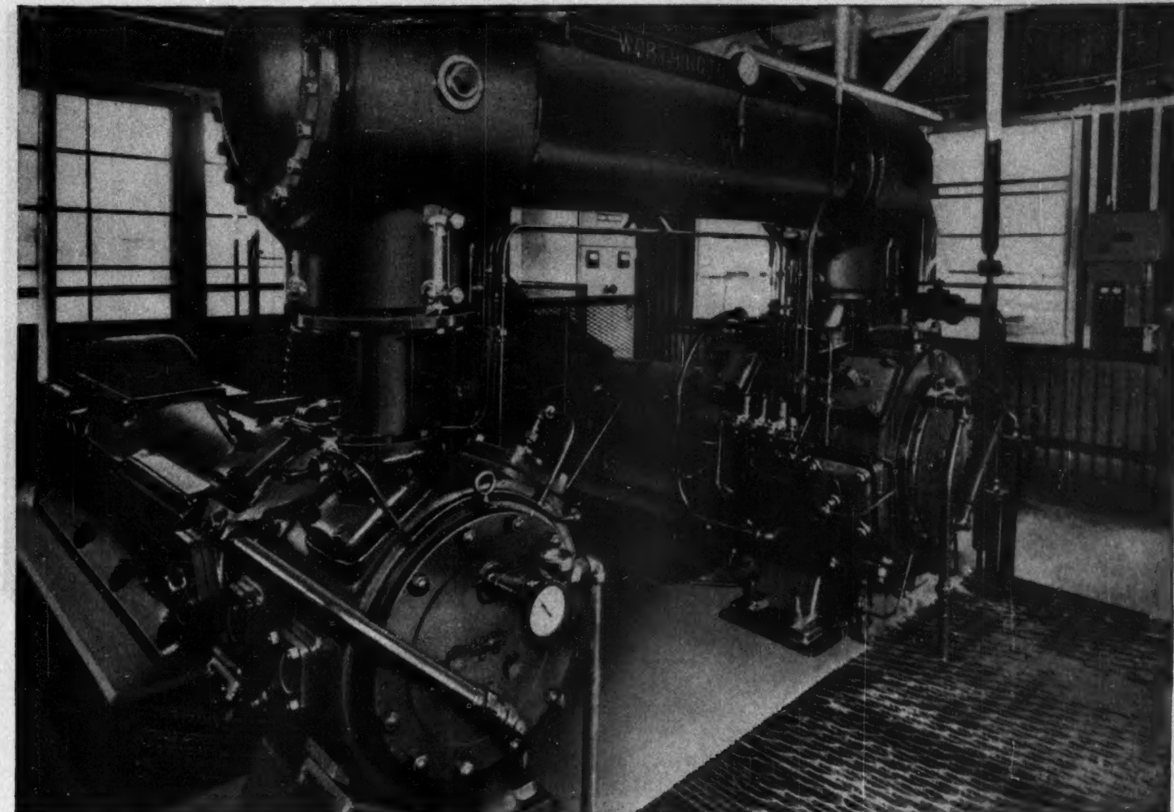


WORTHINGTON HORIZONTAL DUPLEX, TWO-STAGE AMMONIA COMPRESSOR, part of the complete Worthington refrigeration system at Armour's McCook, Ill., chemical plant. System is unusual in that compressors are piped and instrumented to permit two levels of refrigeration—one at 5F, the other at −50F. Engineer and contractor: E. B. Badger & Sons Co., Boston, Mass.

A.2.29

WORTHINGTON

Air Conditioning and Refrigeration



WORTHINGTON DC-2 HORIZONTAL AIR COMPRESSOR, one of 14 Worthington compressors used for various services at the Girard Point, Pa., station of the Gulf Oil Company.

THIS COMPRESSOR KEEPS PACE WITH VARIABLE LOADS

Like compressors in industry everywhere, this installation at a large eastern refinery must face many variable load problems. Unless properly handled, variable compressor loads often result in wasted power and high running costs.

Worthington Five-Step Variable Capacity Control solves this problem.

The by-pass regulation—as achieved by suction valve unloaders and clearance pocket unloaders—is exclusively Worthington and offers these important advantages:

Economy of power—the air required at any moment determines the power used.

Simplicity—inlet valves and unloading mechanism form one individual element, easily accessible.

Low operating temperatures—a cooler cylinder insures improved lubrication and low oil consumption.

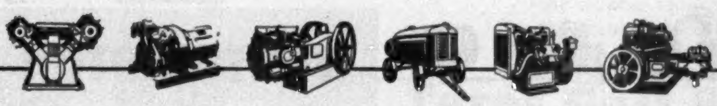
This Type DC-2 compressor is also equipped with the exclusive Worthington Feather* Valve—the lightest and most efficient compressor valve available.

Write for air compressor bulletin L-675-B1B to your nearest Worthington district office or to Worthington Corporation, Compressor Division, Buffalo, New York.

*Reg. U. S. Pat. Off.

A GLANCE AT THE INDICATOR PANEL of the Worthington five-step governor shows operating capacity at any moment.

K.2.13



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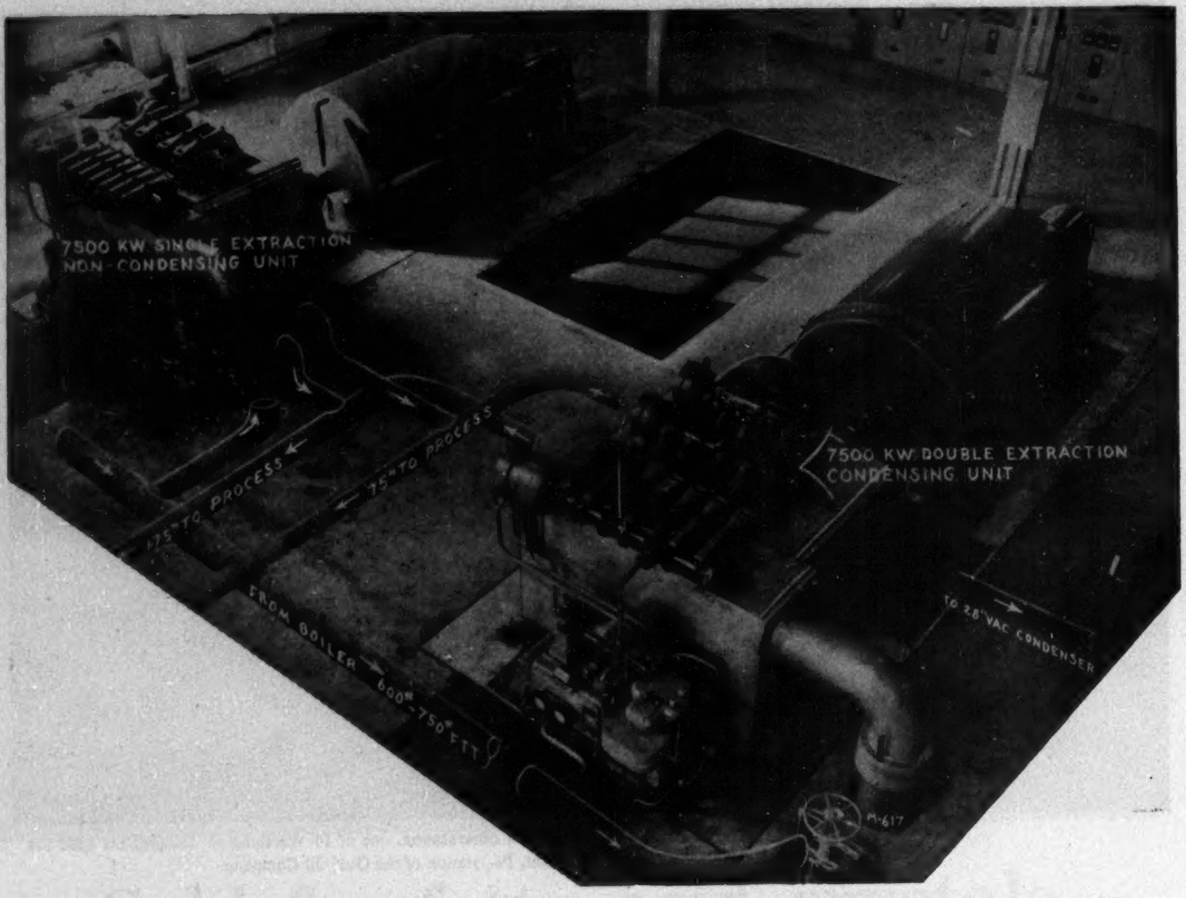


Process Steam Maintained at 2 Pressures

by Worthington Turbine Generators

This is how Worthington and a Far West cellulose mill set up the steam supply for utmost efficiency and flexibility.

We combined a non-condensing single automatic extraction unit with a condensing double automatic extraction unit. The 7500-kw units operate in parallel and, in addition to supplying plant power, furnish steam at two pressures for process requirements.

Along with the advantages of efficient operation and low cost and ability to adjust to mill requirements, this mill benefits from the manufacturer's *unit responsibility*. In this case, Worthington also furnished two 470-hp turbines to drive boiler feed pumps, two 452-hp turbines to drive induced-draft fans, two 146-hp turbines to drive forced-draft fans, and one 50-kw turbine-driven exciter set.

If you want proof *there's more worth in Worthington*, write Worthington Corporation, formerly Worthington Pump and Machinery Corporation, Steam Turbine Division, Wellsville, New York.

T.2.6

A GREAT TEAM IN STEAM

WORTHINGTON

Steam Turbine Generators

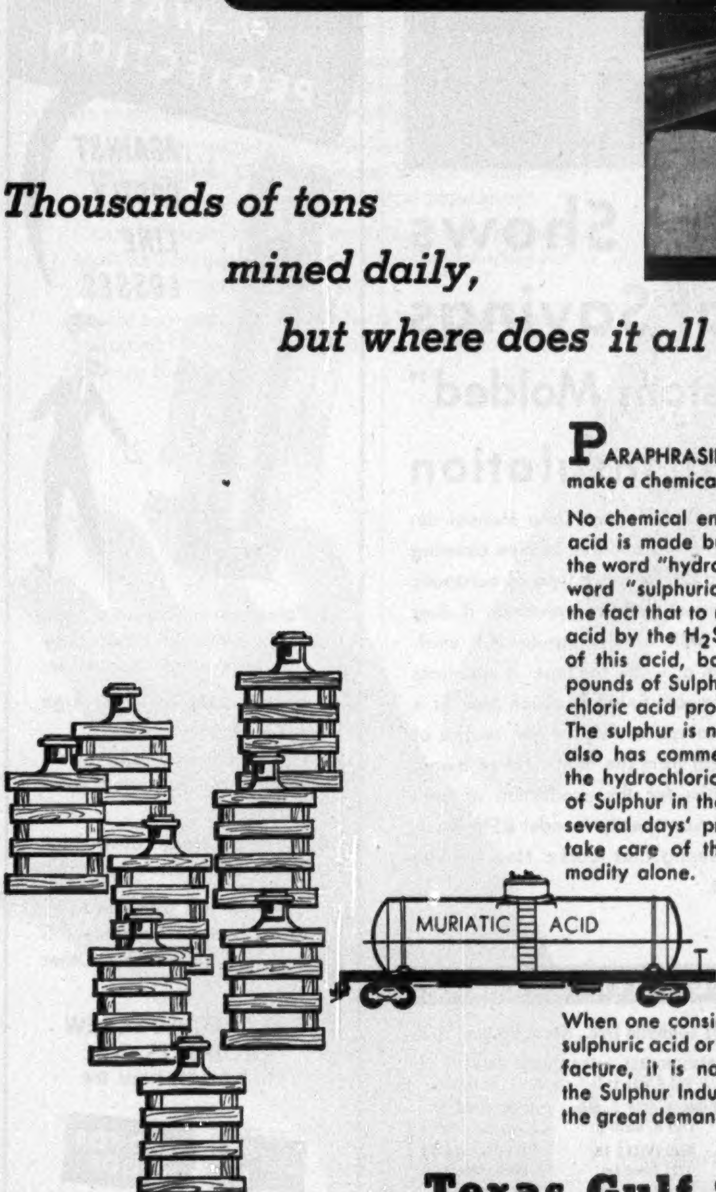
Sulphur

Loading a ship with Sulphur at Galveston

Thousands of tons mined daily, but where does it all go?

PARAPHRASING an old saying: 'It takes a chemical to make a chemical,' certainly applies to hydrochloric acid.

No chemical engineer has to be told how hydrochloric acid is made but sometimes with the mind focussed on the word "hydrochloric" little thought is given to another word "sulphuric." It is this word that calls attention to the fact that to make one net ton of 20° Bé hydrochloric acid by the H_2SO_4 process requires about 950 pounds of this acid, basis 100%, which is equivalent to 320 pounds of Sulphur. About one third of the annual hydrochloric acid production is made by the use of sulphuric. The sulphur is not lost because salt cake, a by-product, also has commercial value. But any way you figure it, the hydrochloric acid industry is an important consumer of Sulphur in the form of sulphuric acid. In fact, it takes several days' production from all the Sulphur mines to take care of the annual production of this one commodity alone.



When one considers all the other chemicals that require sulphuric acid or other Sulphur compounds for their manufacture, it is not difficult to appreciate how faithfully the Sulphur Industry is serving industry today in spite of the great demands made upon it.

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Thus, the ware is subjected to day in, day out tests through use, and practical experience has brought about a number of improvements, among which are:

Improvements in metallurgical processes which have increased its useful life — development of the platinum-rhodium alloy which is now so widely used — design changes like the reinforced rim on crucibles and dishes — development of the low form crucible — improvements in the design of platinum electrodes.

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COPPER ALLOY BULLETIN

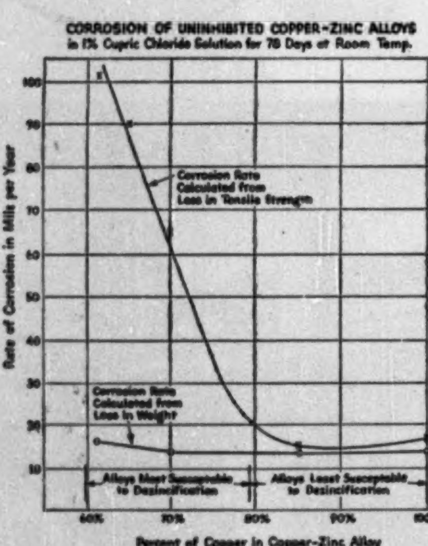
"Bridgeport" MILLS IN BRIDGEPORT, CONN. AND INDIANAPOLIS, IND.—IN CANADA: NORANDA COPPER AND BRASS LIMITED, MONTREAL

Effect of Water Composition and Copper Content of Brass

In the previous issue of the Copper Alloy Bulletin, we discussed various types of dezincification — plug type, layer type, intercrystalline, and Beta phase attack. Now we will deal with the effect of water composition and the part that the copper content of the alloy plays in regard to the corrosion resistance of brass.

Nonscaling Waters Are Corrosive

Dezincification and pitting are most likely to occur in nonscale-forming fresh or salt waters. In such waters copper-base alloys which are resistant to dezincification such as Red Brass and inhibited brasses, Arsenical Muntz, Arsenical Admiralty and Arsenical Aluminum Brass should be used. The other alternative is to hold the mineral balance in the water at such a level that it will be slightly scale-forming.



Effect of pH Values

Dezincification can occur in both fresh and salt waters with the pH ranging from 1.0 to 8.0 or higher. The pH value in itself is not particularly significant. It can, however, become very important where adjustment in the pH may lead to mineral scale formation or the dissolving of mineral scales.

In such media the tendency of plug-type dezincification is more marked in the higher pH range and the tendency for general dezincification is greater in the lower pH range, with a rather broad twilight zone in the central section of the pH scale.

Resistance of Copper-Zinc Alloys Varies with Copper Content

Our laboratory tested the effects of corrosion on uninhibited copper-zinc alloys and copper in 1% cupric chloride solutions at room temperature over a period of 78 days. 1% cupric chloride solution was used because the accelerated corrosion in this medium is comparable to that obtained in sea water over a much longer period.

The depth of corrosion was determined both on the basis of loss in weight and loss in tensile strength which were plotted against the copper content of the copper-zinc alloy tested. The curve for corrosion rate based on loss in tensile strength drops rapidly with increasing copper content and flattens out at 85% copper.

The wide difference between the depth of corrosion based on loss of tensile strength and loss in weight for the alloys tested is due to dezincification which leads to only a relatively small loss in weight but a large loss in tensile strength. The converging of the two curves indicates that where the copper content is 85% or higher, dezincification is not likely to occur.

Arsenic Also Inhibits Dezincification in Cupric Chloride

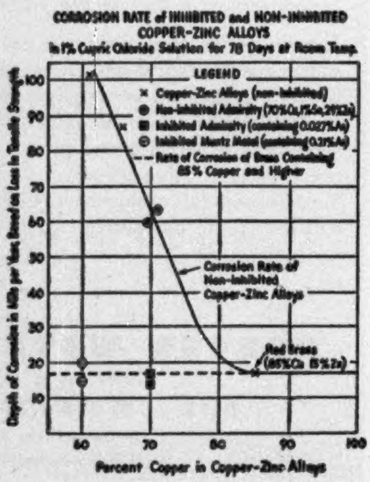
Other corrosion tests, conducted in 1% cupric chloride solutions, revealed that a small percentage of arsenic or other inhibitors alloyed with brasses containing less than 85% copper increased their resistance towards dezincification.

The corrosion rate of the arsenical brasses tested dropped to approximately the same level as that of the uninhibited brasses containing 85% or more copper.

The addition of 1% of tin to brass (Admiralty metal—70% Cu, 29% Zn, 1% Sn), under the conditions of testing, has very little effect on the extent of dezincification. However, Admiralty metal containing 0.027% arsenic and Muntz metal (60% Cu, 40% Zn) containing 0.21% arsenic were practically equal to Red Brass (85% copper, 15% zinc).

Laboratory Service

The above tests clearly indicate the importance of using a dezincification inhibitor such as arsenic, in brass, in order to reduce corrosion attack. By specifying the correct alloy for the manufacture of products exposed to water solutions and weathering, considerable reduction in corrosion's toll can be effected. Contact Bridgeport's nearest district office for your metal requirements and help on your metal problems. (9264)



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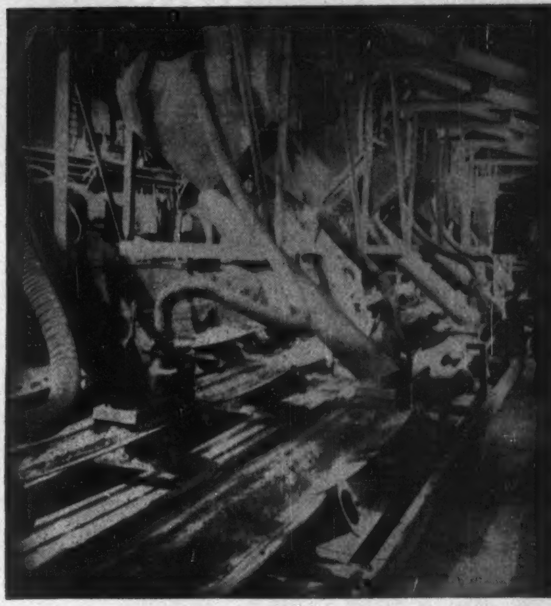

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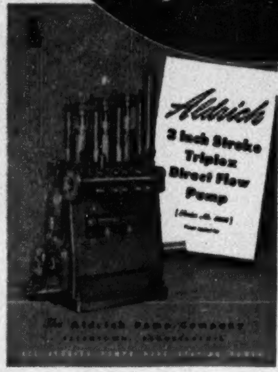

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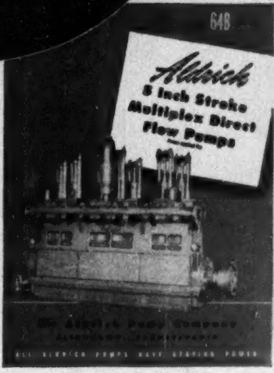

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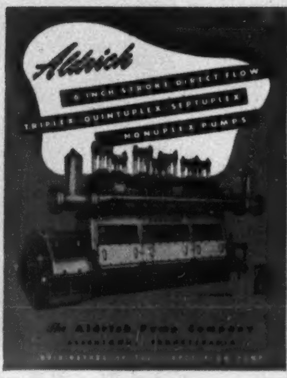

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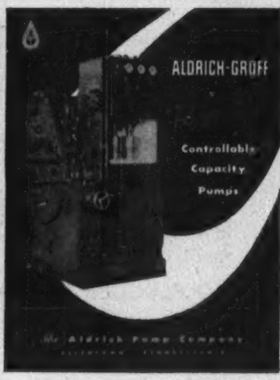

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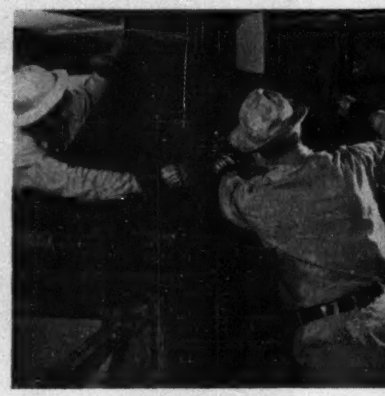

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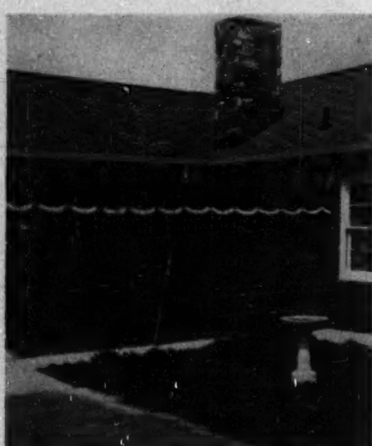

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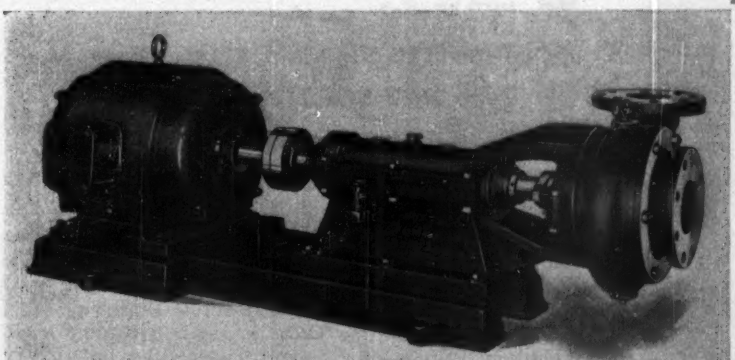

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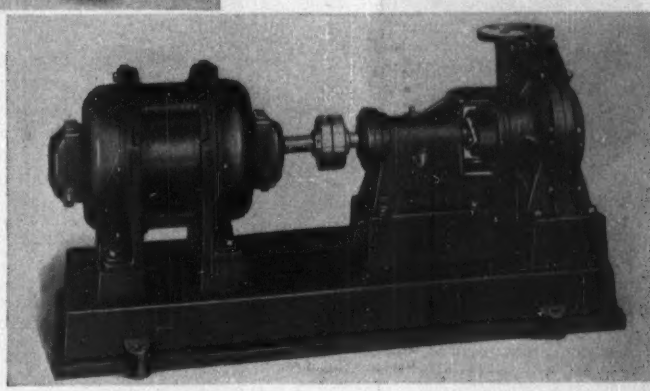

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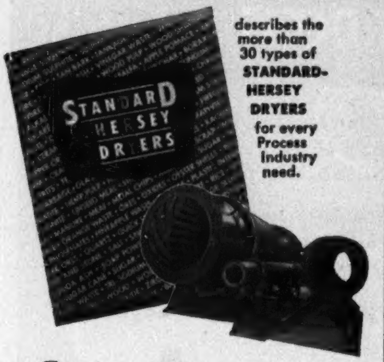

describes the more than 30 types of **STANDARD-HERSEY DRYERS** for every Process Industry need.

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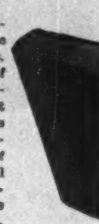
2 INDUSTRIAL WASTE TREATMENT



A practical guide for plant owners, managers, and engineers concerned with the problem of dealing with industrial wastes. Covers the important legal aspects of stream pollution, tells how to secure samples and data, and how to develop and test a method of treatment. Discusses factors of plant design and construction to minimize pollution, and the techniques of reclaiming byproducts from industrial wastes. **By E. B. Besselievre, Chief Sanitary Engineer, International Sales, The Dorr Co., Engineers. 355 pp., 180 illus., $7.00**

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Fig. 2608—200-pound Bronze Globe Throttling Valve that permits FULL FLOW through seat when wide open, thus reducing turbulence and pressure drop to a minimum. Special bronze stem and stainless steel disc and seat hardened to approximately 500 Brinell.

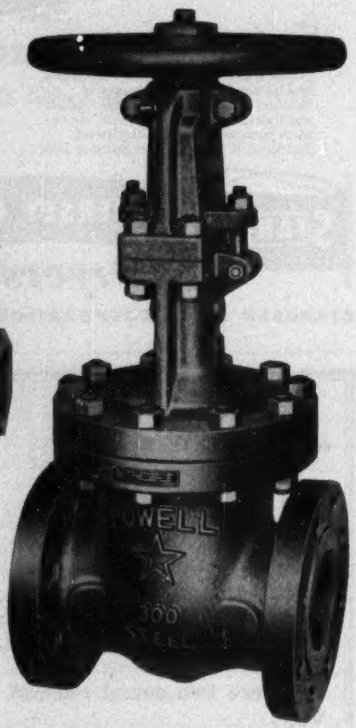

Fig. 3003—300-pound Cast Steel Gate Valve. Flange ends outside screw rising stem, bolted flanged yoke and tapered solid wedge.

Fig. 1793—Large 125-pound Iron Body Bronze Mounted Gate Valve. Made in sizes 2" to 30", incl. Has flanged ends, bolted flanged yoke, outside screw rising stem and tapered solid wedge. Also available in All Iron.

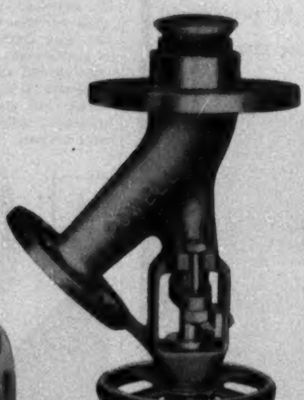

Fig. 2309—Small Flush Bottom Tank Valve with disc rising into tank to open. Sizes ⅜" to 3", incl. Also made with disc lowering into valve (Fig. 2310). Available in sizes 4" to 8", incl., in other designs.

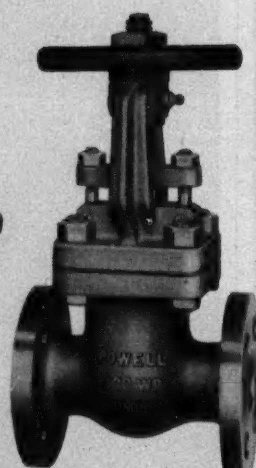

Fig. 2443—100-pound Aluminum Gate Valve. Bolted flanged bonnet, outside screw and yoke. Stem rises through revolving bushing in upper yoke. Stainless steel stem and interchangeable solid or split wedges that are precision-fitted and accurately guided throughout entire travel. Sizes ½" to 2", incl. Screwed end valves are also available.

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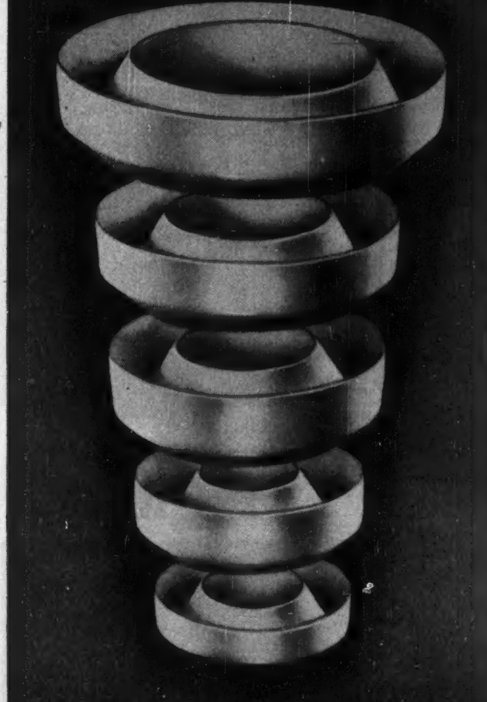

First in preference **in leading chemical plants** *everywhere!*

because... **Teflon "C-V" Rings withstand**

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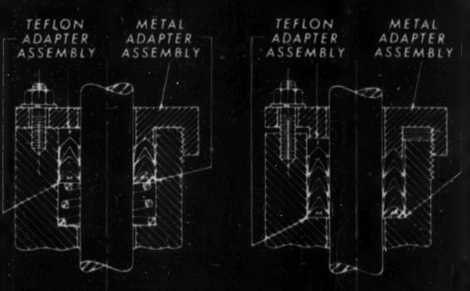
2. Any corrosive liquid or gas

Why repack with ordinary materials when chemically inert "John Crane" Teflon "C-V" Rings can seal any corrosive liquid or gas and resist extreme temperatures? Also, they have extremely low friction characteristics—will not shrink, swell, harden, dissolve, corrode or deteriorate. Ideal for use on all valve stems and reciprocating pumps as well as many centrifugal and rotary pump applications. Cross-section design allows effective sealing at finger tight gland pressure.

"John Crane" has developed a complete line of standard size Teflon "C-V" Rings and male and female adapter rings to meet practically every need. If you have special requirements, "John Crane" can mold additional sizes to fit your stuffing box requirements.



SPRING ASSEMBLY — SOLID ASSEMBLY

"John Crane" Teflon "C-V" Rings are used in sets, the number of rings depending upon the stuffing box length and pressure encountered. In all cases, a minimum of two rings are recommended for a stuffing box, together with male and female adapters.

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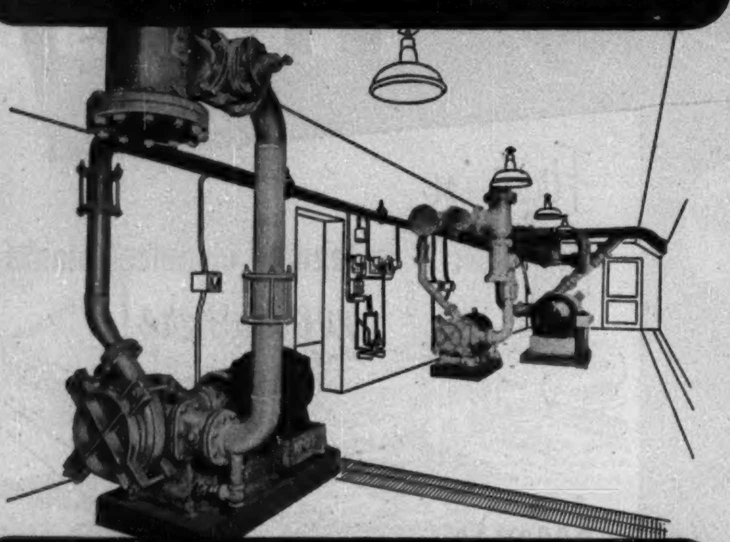

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Heavy viscous slurries with solids ratios as high as 70% by volume are not unusual loads for a Morris Type R Slurry Pump.

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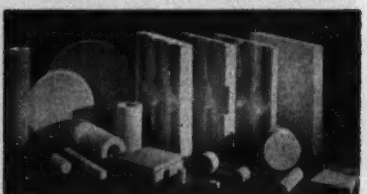

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SPECIALLY PRICED

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2—Ball & Jewell #2 Rotary Cutters.
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4—Traylor Tube Mills, 5' x 22', 5' x 20', 4'6" x 18'6", 4' x 13', each stone-lined, scoop feed, pebble charge, clutch pulley.

Still installed in one plant as operated, with all accessories as used.

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1—7'6"x125'; 1—8'x135' Allis Chalmers Rotary Kilns.
4—Ruggles-Coles Direct Heat Rotary Dryers—Class XF4—54"x25', 1 Class XF 5'x40'. Also L-B 2'7"x10' Roto Louvre; three 3'x50'; 5'x30'; 5'x50'; 6'x40'; 6'x60'; 7'x70'.
3—6'x50' Louisville Rotary Steam Tube.
1—4'x6' Flaker or Cooling Roll.
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2—#12 Sweetland Filters for 36 leaves on 4" c.c.
10—Shriver 42"x42", Iron Filler Presses, Plate & Frame, 18, 27, 36, 54 chambers, 1" cake.
16—Sperry 18'xx18', Iron, P & F, Filter Presses, closed delivery, 11 chambers.
1—American Disc Filter 6' dia., 2 disc, 100 sq. ft. filtering area, with auxiliaries.
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1—8'x12' Oliver Lead-Wood Vacuum Filter Acid-Resisting.
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1—ALUMINUM Sperry FILTER PRESS, 30 x300", 45 chambers, 1" cake.
1—Sperry, 24"x24" P & F Filter Press with 25 chambers, 2" frames.
1—#7 Sweetland Filter with 20 steel leaves, 4" c.c., NEW 1951.

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4—3000 gallon, size 30, type X-BS, welded.
1—20 gal. jkt., Dbl. Sigma Blades, M.D.

NEW STAINLESS STEEL FABRICATION

We have available excellent facilities for fabricating Stainless Steel Tanks, Kettles, Condensers, Reactors, Autoclaves, Distillation Columns, Filter Presses, Heat Exchangers, etc.
ASME Code Construction

Will gladly furnish estimates to your specifications.

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1—Kilby jacketed Horiz. Ribbon Mixer, 450 cu. ft. capacity.
1—Howes 3,0000#, double ribbon.
1—Day Size F, 1850#; 1—Howes 1,800# dbl. ribbon; 1—Munson Rotary 1,000# batch; 1—Day 400#.

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1—Quadruple Effect Evaporator, calandria type, brass tubes, 14,000 sq. ft. H.S.; excellent condition; still erected; complete with piping, etc.
4—Mojonnier S/S Vac. Pans, 3', 4', 5', 6'.

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1—Battery of two 3'x5' Tyler Hummer, Type 33, with Generator Set for both.
1—3'x8' Selectro, single deck.
1—3'x6' Selectro, single deck.
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1—18"x5' Selectro—rebuilt.
1—Day S/S single deck, 40"x84".
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1—#5057 Raymond 5-roll, high side, with oil journals. Complete.
1—4'6x7" Ball Mill, Allis Chalmers, iron lined. Used 100 hours.
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All porcelain lined

3—5' x 4', 235 gal.
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1—Abbe #4 porcelain lined, 125 gal., 45" x 42".
1—Patterson 24 v 36", 25 gal.

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2—500 gal. steel jacketed closed agitated Vacuum Reactors.
1—Stainless Lee 300 gal. Style A.
6—Dopp C.I. 80, 100, 150, 350, 600 gal.
7—Steel, agitated, 350, 500, 700, 800.
2—700 gal. closed, with Simplex Turbo Mixers, reduction drive, m.d.
3—9500 gal., welded, agitated, open.
29—Aluminum and Copper, 30 gal. to 800 gal., some agitated.

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1—42" x 120" Buflovak Atmospheric S/S Conveyors, S/S Elevator, S/S Hood.
4—5' x 12' Buflovak Atmospheric.
2—32" x 90" Buflovak Atmospheric.
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1—42" Stainless Steel A.T.&M. Co. Centrifugal, 40 H.P. Motor.
1—Tolhurst 40" monel Centrifugal.
1—13,500 gal. Stainless Steel Tank, closed, agitated, S/S coils, m.d.
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2—Buflovak 6' dia. Vacuum Crystallizers; 1—6' dia. Atmospheric, jacketed.
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2—Dorr two-stage Classifiers, each with two rakes, total length 27', gear reducer and motor.
1—Davenport #3A Dewaterer, with speed reducer and 5 HP AC motor.
1—Mechanical Cooker, 5' dia. x 16 long, jacketed, agitated, Insur. Certificate.

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1—Banbury Size B Laboratory Mixer with Motor & Reducer.
12—Simpson #0 Intensive Mixers "Unused".
1—Readco Stainless Steel Jacketed Double Arm Jacketed Mixer, Sigma Blades, 225 Gals.
1—Buflovak Stainless Steel Rotary Vacuum Dryer, 3' x 15'.
1—Baker Perkins Stainless Steel Dispersion Mixer, Size 15, Type VUMM, 100 gals. working cap., 150 gals. total cap., 75 HP Drive.
1—Baker Perkins Stainless Steel Jacketed Lab. Mixer, Size 4, with 2 HP Exp. Proof Motor, 0.7 gals. cap. Sigma Blades.
1—Patterson Stainless Steel Autoclave, 225 gals. cap. with stainless steel turbo agitator, 225 PSI internal pressure.
1—Glascote glass lined jack. vac. reactor, 1600 gals. cap. (Unused).
1—Combustion Engineer Stainless Steel jacketed autoclave, 500 gal. cap., 300 PSI internal pressure.
1—Struthers Wells Hastelloy B Heat Exchanger, 450 sq. ft.

THE GELB GIRL—JANUARY 1953

DRYERS—KILNS

1—Louisville Rotary Steam Tube Dryer, 6'x50'.
1—Huhn Rotary Steam Tube Dryer, 3'x12'.
2—Buflovak Vacuum Drum Dryers, 24"x20".
2—Buflovak stainless steel double drum dryers, 6"x8", vacuum and atmospheric.
1—Buflovak Double Drum Dryer, 32"x90".
20—J. P. Devine Lab. Vacuum Shelf Dryers, 5 shelves.
1—J. P. Devine Rotary Vacuum Dryer, 5'x25'.
2—J. P. Devine Vacuum Shelf Dryers, 9 shelves.
1—F. J. Stokes Vacuum Shelf Dryer, Model #138-13, 12 shelves.
2—Buflovak Double Door Vacuum Shelf Dryers, 20 shelves each.

FILTERS

3—Shriver 24"x24" Aluminum Plate & Frame Filter Presses, Closed Delivery, 35 Chambers each.
1—Sperry 42"x42" Aluminum Plate & Frame Filter Press, 3" Frames, Closed Delivery, 35 Chambers "Unused".
1—Sperry 42"x42" Cast Iron Plate & Frame Filter Press, 16 Chambers, Closed Delivery.
1—Sperry 12" Bronze Plate & Frame Filter Press, Closed Delivery, 9 Chambers.
1—Shriver 42"x42" Evedur (Bronze) Plate & Frame Filter Press, 40 Chambers. Closed Delivery.
1—Shriver 36"x36" Cast Iron Plate & Frame Filter Press, Steam Jacketed, 48 Chambers, Closed Delivery.
3—Shriver 36"x36" Cast Iron Plate & Frame Filter Presses, Closed Delivery, 24 & 25 Chambers.
4—Sperry 12"x12" Cast Iron Plate & Frame Filter Presses, 12 and 20 Chambers.
5—Sweetland Filters, #2, 5, 7 and 12.
2—Oliver Rotary Vacuum Filters, 5'3"x6', steel construction with monel screens.
1—Oliver Rotary Steel Filter 3'x1'.
2—Shriver 24"x24" cast iron, closed delivery, filter presses, 3 eye, 23 chambers each.

CENTRIFUGALS

2—A. T. & M. Stainless Steel Suspended Type Centrifuges, 48" Imperforated Baskets with motors.
1—A. T. & M. Stainless Steel Suspended Type Centrifuge, 54" Imperforated Basket with motors.
2—Fletcher 40" Whirlwind Centrifuges, Bronze Perforated Basket with Explosion Proof Motors.
1—Tolhurst Stainless Steel Suspended Type Centrifuge, 40" Imperforated Basket.
1—Fletcher 48" Whirlwind Centrifuge, Bronze Perforated Basket with Explosion Proof Motor.
1—Tolhurst Center Slung Centrifuge, 36" Perforated Steel Basket with Explosion Proof Motor.
1—Sharples Stainless Steel Super D Canter, Model PN-14.
6—Sharples #16-Y Stainless Steel Super Clarifying Centrifuges.

MIXERS

2—Banbury Mixers #1 and #9.
1—Simpson #1 Intensive Mixer.
4—Baker Perkins Steel Jacketed Mixers, Sigma Blades, 100 Gals.
3—Baker Perkins Stainless Steel Jacketed Mixers, Sigma Blades, 100 Gals.
1—J. H. Day Mogul Vacuum Mixer, Sigma Blades, 2½ Gals.
1—J. H. Day Jacketed Powder Mixer, 5000 lbs. Center Discharge.
3—Turbo Steel Jack. Mixers, 700 Gals. Each.

PULVERIZERS—GRINDERS—MILLS

1—Mikro #3TH Mikro Pulverizer with 30 HP Motor.
1—Mikro #3W Pulverizer.
1—Mikro #2TH Pulverizer, Stainless Steel & Bronze Construction, with Motor.
1—Mikro #1SH Pulverizer with Motor.
1—Ball & Jewell #0 S.S. Rotary Cutter.
2—Ball & Jewell #2 Rotary Cutters.
1—Blaw Knox Air Mill Pulverizer.
1—Mikro Stainless Steel Atomizer #6.
3—Thropp 2-Roll Rubber Mills, 18"x50".
1—Abbe #2 Buhrstone lined Pebble Mill, 5'x4'.
1—Gruendler #24-40 Hammer Mill.
1—Thropp 2-Roll Rubber Mill, 10"x24".

SPECIALS

1—Swanson-Walker type 316 S.S. Crystalizer, 4—10' sections.
1—Buflovak type VRC Double Effect Monel Evaporator 250 sq. ft. each effect.

AUTOCLAVES—KETTLES—TANKS

1—Adamson Steel Vulcanizer 6'x20'.
1—Stainless Steel Storage Tank, 10,000 gals.
2—Blaw Knox Steel Jacketed Autoclaves, 300 & 500 Gals. Cap., Working Pressure 500 Lbs.
1—Patterson Steel Jacketed Autoclave, 900 Gals. Cap., Internal Pressure 120 Lbs.
1—Stainless Steel High Pressure Autoclave, 10 Gals. Cap., 250 Lbs. Internal Pressure.
1—Pfaudler Glass Lined Jacketed Vacuum Reactor, 500 Gals. Cap.
1—Pfaudler Glass Lined Jacketed Kettle with Anchor Type Agitator, 150 Gals.
12—Koven Stainless Steel Jacketed Vacuum Kettles, 380 Gals. Cap.
1—Koven S. S. Storage Tank, 1200 Gals. Cap.
1—Koven Steel Mixing Tank, 1200 Gals. Cap. with Nettco Drive, 10 HP Explosion Proof Motor, Turbin Agitator.
1—Artesian Steel Jacketed Kettle, 1,000 Gals. Cap., with Rake Type Agitator, ASME Code, 50 Lbs. Pressure.
2—J. P. Devine Jacketed Vacuum Reactors, 2,000 Gals. Cap. Each.
3—Buffalo Steel Pressure Tanks, 1,000 & 10,000 Gals. Cap., 100 & 125 PSI, ASME Coded.
2—Steel Storage Tanks, 6,700 Gals. Cap. Each, 80 PSI.
10—Steel Fermenting Tanks, 1300 Gals. Each, with Coils & Agitators, 80 PSI.
25—Steel Storage Tanks, 9,000-17,500 Gals.
1—Steel Rubber Lined Storage Tank, 4,500 Gals. Cap.

MISCELLANEOUS

3—Vulcan all Copper Condensers, 308 & 350 sq. ft.
1—Abbe #2 Master Rotary Cutter.
1—Orville Simpson #41 Rotex Screen.
1—Dayton Dowd Centrifugal Pump, Stainless Steel, Size 1C8, 35 GPM at 40' head, speed 1745 RPM, 2"x1".
1—Worthington Worthite Pump, with 7½ HP Motor.
2—Worthington Antaciron Centrifugal Pumps, Model #3 CU1, 4"x3".
1—Lightning Mixer, Model SAG 1000, 10 HP explosion proof motor.
1—Netco Drive, Model WT 27, with 3 HP Motor, 900 RPM, Ratio 53-1, Shaft RPM 16.15.

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R. GELB & SONS, Inc.,

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COLUMNS—STILLS

2 Aluminum Bubble Cap Columns, 36" dia. x 45 plate.
1 Aluminum Bubble Cap Column, 27" dia. x 18 plate.
1 Aluminum Perforated Plate Column, 28" dia. x 36" plate.
1 Copper Column with 18—30" dia. perforated plates and 10—24" dia. bubble cap plates.
1 Steel and Cast Iron Bubble Cap Column, 30" dia. x 62 plate.
1 Stainless Steel T316 direct fired Vacuum Still, 325 gal.

CONDENSERS—EXCHANGERS

3 Aluminum tub. 166 sq. ft.
15 Alum. Coil Exch. 47 sq. ft.
7 Copper tub. 20, 65, 90, 95, 140, 325, 725 sq. ft.
3 S.S. tub. 8½, 330 & 400 sq. ft.
3 S.S. Coil Condensers, 40 sq. ft., 60# pr.

DRYERS—EVAPORATORS

1 Stokes #59A Jacketed Vacuum Rotary Dryer, 18" dia. x 42" long.
2 Atm. Double Drum Dryers, 22" x 38".
1 Cummer Rotary Hot Air Dryer, 46" dia. x 26' long.

FILTERS

1 Sweetland #5, 30 lvs.
1 Sweetland #12, 72 lvs.
1 Swenson Rotary Continuous Vacuum Filter; Precoat type, 8' dia. x 8' face, rubber covered and lead acid proof construction.
1 FEINC Rotary Vacuum Filter, string discharge, 4'6" dia. x 6' face, aluminum.
4 Pressure Leaf Filters, 70 to 90 sq. ft.
2 Shriver 36" Filter Presses, rubber covered, closed dely., washing, hydr. closing.
1 Louisville 8-roll Continuous Filter or Grains Press 24".

NOW LIQUIDATING

Equipment of Patrick Henry Brewery, Marion, Indiana:
32—Horiz. Welded Steel Tanks, dished heads: 10,500, 11,300 and 12,700 gal.
6—5500 gal. Vertical Closed Welded Steel Tanks, dished heads.
22—8300 gal. Welded Steel Rectang. open top tanks—16'10" L x 7'7" W x 8'9" H.
1—4000 gal. Vertical Steel Cooker, Jktd., Agit.
1—Dracco Pneumatic Grain Conveying System.
1—Sperry 24" C.I. Filter Press, 16 Ch.
3—Ammonia Compressors with motors: 10 x 10 (82 ton); 9 x 9 (60 ton); 7½ x 7½ (45 ton).
4—Steel Shell & Tube Ammonia Condensers: 300 sq. ft. and 1000 sq. ft.
8—50 cu. ft. Steel CO_2 Storage Tanks ASME, 245# WP.
2000 ft. of Gravity Conveyor, Power Belt Conveyor, etc.
Lot of miscellaneous equipment—pumps, coolers, scales, kettles, tanks, conveyors, bottling machinery, machine shop and office equipment, etc.

NOW LIQUIDATING

Equipment of Chemical Manufacturing and Distributing Co., Easton, Pa.:
1—500 gal. Pfaudler glass lined kettle
1—Lightnin Agitator 3 HP—431 RPM
1—Mikro Pulverizer #1-SI
1—Viking Rotary Pump, 3", 20 HP
1—1000 gal. Stainless Clad Tank
1—2000 lb. Jacketed Powder Mixer
3—Ribbon Mixers—2000#, 1000#, 800#
Lot of Steel Storage Tanks, Kettles, mixing tanks, pumps, scales, etc.

KETTLES—REACTORS

1 6 gal. Nickel Autoclave, agit., 1000# pr.
1 Stainless Steel, Type 347 Autoclave or pressure tank, 250# pr., Elec. heated 850° F; 17¼" dia. x 9' high.
70 Stainless Steel and Stainless Clad open top, steam jacketed kettles—10, 40, 60, 80, 100, 150, 250, 500 gal. sizes.
1 Stainless Steel Kettle, 950 gal., 20# jkt. pr., vertical agitator, Type 347 shell, bolted C.I. top.
3 300 gal. T316 Stainless Steel Jacketed Tanks, 10# water jkt. double motion agitators.
1 200 gal. Read Stainless Steel Jacketed Kettle, open top, double motion agitator, 10 HP motor.
1 3000 gal. Horiz. Steel Cooker, Vacuum, Agitated.
1 4000 gal. Vertical Steel Cooker agitated.
4 Aluminum Reaction Kettles, Jkid. & Agit., 25, 60 & 100 gal.
2 Copper Jacketed Agitated Vacuum Kettles, 4' dia. x 4' deep, double motion agitator.

MILLS—PULVERIZERS

1 Paul Abbe #6 Pebble Mill, porcelain lined, 32" x 36".
1 Abbe #4A Pebble Mill, 45" x 48".
1 Hardinge Conical Ball Mill, Steel Liner, 4'6" dia. x 24" long.
1 Williams Hammer Mill, type AK; size A, stainless steel.
5 Mikro Pulverizers, #1-SH, #1-SI, #2-SI, #2-TH.
2 Premier Colloid Mills, 6" st. st. rotor, type U-3 & V-3.

MIXERS—AGITATORS

12 Vertical Agitators—40 HP gearmotor with Turbo #5B vertical drive, steel shaft and turbine impeller 70 RPM.
1 Porter heavy duty jacketed double worm mixer—75 gal.
1 Dellenberger 100 gal. Heavy Duty Double Arm Mixer, fish-tail blades, jacketed.

STAINLESS STEEL FABRICATION

"Heliarc" welding. Water-quenched welds (if specified). Specializing in lighter weight tanks (10 ga., 12 ga., 14 ga., 16 ga., etc.). Large quantity of type 304 and type 316 sheets carried in stock assuring quick delivery of tanks built to your specifications. Over 30 NEW tanks in stock for immediate shipment—from 30 gal. to 5700 gal. sizes.

Write: Attn. Fabricating Division

TANKS

35 Aluminum Tanks, closed, 4, 275, 330, 480, 500, 1350 & 1450, 9000 gal.
15 Horiz. Welded Steel Tanks, Lastiglas Lined, 15,200 gal.
1 Vertical Rubber Lined, 6000 gal. open.
5 Vertical Jacketed Pressure Tanks—Steel—30# steam jacket—6mm vacuum internally:
3—34" ID x 15' H (approx. 700 gal.)
1—23" ID x 10' H (approx. 230 gal.)
1—23" ID x 9' H (approx. 195 gal.)
8 15,000 gal. Vertical Welded Steel Closed Fermenting Tanks, 80 lbs. W.P., turbine agitator with 40 HP motor; 970 lin. ft. 3" pipe coil. Excellent condition.

STAINLESS STEEL TANKS IN STOCK

1 16,200 gal. Vert., closed, T304—NEW
1 5700 gal. Horiz. T304—NEW
1 4200 gal. Vert., closed, T304—NEW
1 1400 gal., Vert., open, 10' L x 57" W x 57" D
2 1000 gal. Vert. T304
2 500 gal. Vert., T304—NEW
50 Stainless Steel Tanks—from 9 gal. to 500 gal. sizes
9 3000 gal. Horizontal Stainless Steel Tanks, 5'4" dia. x 18'9" long, insulated and agitated. Excellent for transporting, storage or holding.

MISCELLANEOUS

1 Bin, 400 cu. ft., T316, St. St.
2 Bird Susp. Centrifugals, 48" dia. Stainless Steel Perforated Baskets.
1 Bird Suspended 48" Steel Centrifugal. Perforated basket; Bottom discharge.
1 Fletcher 30" Jr. Centrifugal Extractor, St. St. Imperf. basket.
1 Sharples #16 Super Centrifuge, stainless steel.
5 DeLaval Centrifuges, models #600, 74-11 and 94-01.
1 Deionizing System, 500 GPH. Zeolite.
2 Kux Machine Co. Model 25 Rotary Pellet Presses, 21 and 25 punch.
3 Stokes Rotary Pellet Presses, 16 punch, B-2, D-3.
1 Byron Jackson Deep Well Pump, 150 GPM 325' head, NEW.
4 Selectro Vibrating Screens, stainless steel, 2' x 7', double deck, enclosed.
1 Stainless Steel Horizontal Sterilizer or Steam Retort, 10# pr., 24"W x 28"H x 36"L.
1 Stokes Vertical Steel Jacketed Vacuum Chamber and Impregnating tank, 30"L x 25"W x 24"D.

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DRYERS—KILNS

2—Vulcan 7' x 160', 7' x 110', 5/8" shell, 2-12" tires, complete.
1—Allis-Chalmers 10' x 90', 9/16" shell, 2-14" tires, complete.
1—York 6' x 60', 3/8" shell, 2-5" face tires.
1—Ames 6' x 60', 3/4" shell, 2-8" tires.
1—Vulcan 4½' x 50', 3/8" shell, 2-6" tires.
1—5' x 15' brick-lined, 2 tires complete.
6—Rotary Dryers 7' x 70', 7' x 60', 5' x 67', 4'6" x 40', 4' x 25'.
3—Louisville Rotary Steam Tube Dryers 6' x 50', 6' x 30', 3' x 20'.
1—Louisville Rotary Steam Tube Dryer 6' x 27', S.S. tubes.
2—Devine 17 shelf double door vacuum Dryers 59" x 78".
2—Devine 10 and 6 shelf vacuum dryers 40" x 43".
5—Stokes & Buflovak Rotary Vacuum Dryers 30" x 8', 3' x 15', 6'6" x 38'.
5—Buflovak 60" x 144", 42" x 120", 32" x 90" Atmospheric Double Drum.
1—Single Drum 60" x 80" Flaker.
1—14 Truck steam heated Dryer 1680 sq. ft.
1—Pittsburgh Lectro Dryer size X, type CH.
3—Buflovak 6' diameter, Vacuum and Atmospheric Crystallizers.

FILTERS

2—Oliver Monel 8' x 10' Rotary-Vac Filters.
2—Oliver 5'3" x 3' Rotary Vacuum enclosed Precoat Filters.
7—Oliver Rotary Vacuum 11'6" x 14', 8' x 12', 8' x 10', 8' x 8', 3' x 1'.
3—Eimco Rotary-Vac 8' x 8', 4' x 5', 4' x 4'.
1—Feinc Rotary Vacuum 8' x 12' steel.
1—Sweetland #12 with 36 leaves.
1—Sweetland #7 with 27 leaves.
1—Sperry 36" Recessed, 48 chambers, c.i., open delivery.
5—Shriver 30" P&F, 30 chambers, c.i., open delivery.
8—Sperry 24" P&F, 16 chambers, c.i., closed delivery.
1—Shriver 24" Recessed, 30 chambers, c.i., open delivery.
3—Shriver 18" Recessed, 30 chambers, c.i., open delivery.
2—Sperry Aluminum 30" and 24" P&F, 22 and 26 chambers.
10—Shriver, Sperry Filter Press Skeletons 42" to 18".

CENTRIFUGALS

1—Fletcher 48" Suspended Aluminum bottom discharge, perforated basket, motor-driven.
1—AT&M 42" Suspended SS, bottom discharge, perforated.
1—Fletcher 40" Suspended, bottom discharge, SS, perforated basket.
1—Tolhurst 32" Suspended Monel, bottom discharge, perforated.
1—Fletcher 30" Suspended Steel, bottom discharge, perforated.
1—Tolhurst 26" suspended Monel, bottom discharge, perforated.
1—Tolhurst 26" suspended, steel, bottom discharge, perforated.
2—Bird 36" x 50" solid bowl, rubber and stainless.
1—Bird 36" x 50 solid bowl, steel.
1—Bird 18" x 28" solid bowl, steel.
2—Sharples #16P Monel Super Centrifuge.

Our Best Wishes for the New Year

LIQUIDATION

1—New Vulcan 8'x83' Kiln.
1—Peabody 25,000 CFM Scrubber.
3—Concrete Stave Tanks 20'x20' with acid lined brick.
6—Butler Barrel Loaders and Morgan Drum Fillers.
6—Steel Storage Bins 15'x12', Cone bottoms.
3—Riley Coal Crushers
1—American Pulverizer Co. 24x24 ring Crusher, 30 HP motor.
1—103' centers, scraper flight Conveyer.
1—Electro Dryer, size X, Type CH, 3,000 cubic feet.
2—West. Frequency Changers, 60 KW with 60 HP motors.
11—Atomizer Assemblies with 20 HP, 10,000 RPM Vert. motors.
2—Durimet 6x6 Cent. Pumps.
1—Quadruple Effect Evaporator, 1000 square feet per effect, 8'x9' bodies, all copper.
20—All copper 5'x16' and 4'x12' Pressure Vessels.
2—25,000 square foot Lille Quadruple Effect Evaporators, all copper.
6—8'x10' Coil Pans, all copper.
50—Copper Tanks 3'x3' to 10'x10', with and without Agitators.
10—Cypress wood Stave Tanks with and without Brass Agitators.
Motors, copper and steel pipe, valves, steel plate, structural steel, etc.

PULVERIZERS

2—Raymond 4 roll High Side Mills, complete.
5—Al. Ch. 6' x 22' steel lined Tube Mills.
1—Hardinge 4½' x 16" Conical steel-lined Ball Mill, 30 HP motor.
1—Bauer 36" Attrition Mill 2-50 HP motors.
17—Patterson, Abbe Pebble & Ball Mills 60 to 1000 gals.
2—Premier Colloid Mills 8" dia., S.S.
1—Eppenbach QV7 Colloid Mill.
2—Jeffrey 36" x 24", 20" x 12" Hammer Mills.
3—Raymond, Gayco Mechanical Separators 14', 12', 4'.
1—2 Roll Rubber Mill 6" x 12".
2—Mikro No. 1S1, No. 1SH Pulverizers.
1—Fitzpatrick Comminuting Mill 7½ HP.

SCREENS

1—Selectro S.S. double deck 4' x 10'.
5—Sprout Waldron S.S. sgle. deck, 40" x 84".
1—Robinson Triple Deck 40" x 104".
4—Rotex #42, #22 and #11 Single and Double Deck Screens.
5—Tyler Hummer 3' x 5' Triple Deck.
1—Abbe #2 Blutergess Sifter.
1—Selectro Double Deck 18" x 48".

MIXERS—ALL TYPES

4—Baker Perkins 200, 100, and 50 gallon, jacketed, double arm, sigma blades.
1—Baker Perkins 300 gal. Unidor S.S.
1—Baker Perkins ½ gal., jacketed.
1—Baker Perkins, type JNM, 100 gal., jacketed, double arm.
1—Day 30 gal. Imperial jack. double arm.
10—Rodgers 200 to 3000# Powder Mixers.
12—Electric, Port. Agitators ¼ to 5 HP, NEW.
4—Day, Ross, 8 and 50 gal. Pony Mixers.

MISCELLANEOUS

20—Bucket Elevators, steel housing, 34' to 90' centers, 8" x 5" to 24" x 8" buckets.
7—Stokes Vacuum Pumps 15 to 100 CFM.
1—Milton Roy Proportioneer Pump, S.S. and Hastelloy, 10 GPM.
5—Devine, Buflovak, Condensers and Receivers, 20 to 90 sq. ft.
7—Groen 150, 125 gal., S.S., jacketed, agitated, kettles.
4—Stokes DD2, D4 Rotary Tablet Machines.
5—38" dia. Stainless Steel Revolving Pans.
2—Nash #4, AL671 Vacuum Pumps.
10—Olivite, Duriron, Rubber, Durimet and Haveg Centrifugal Pumps 6" to 4".

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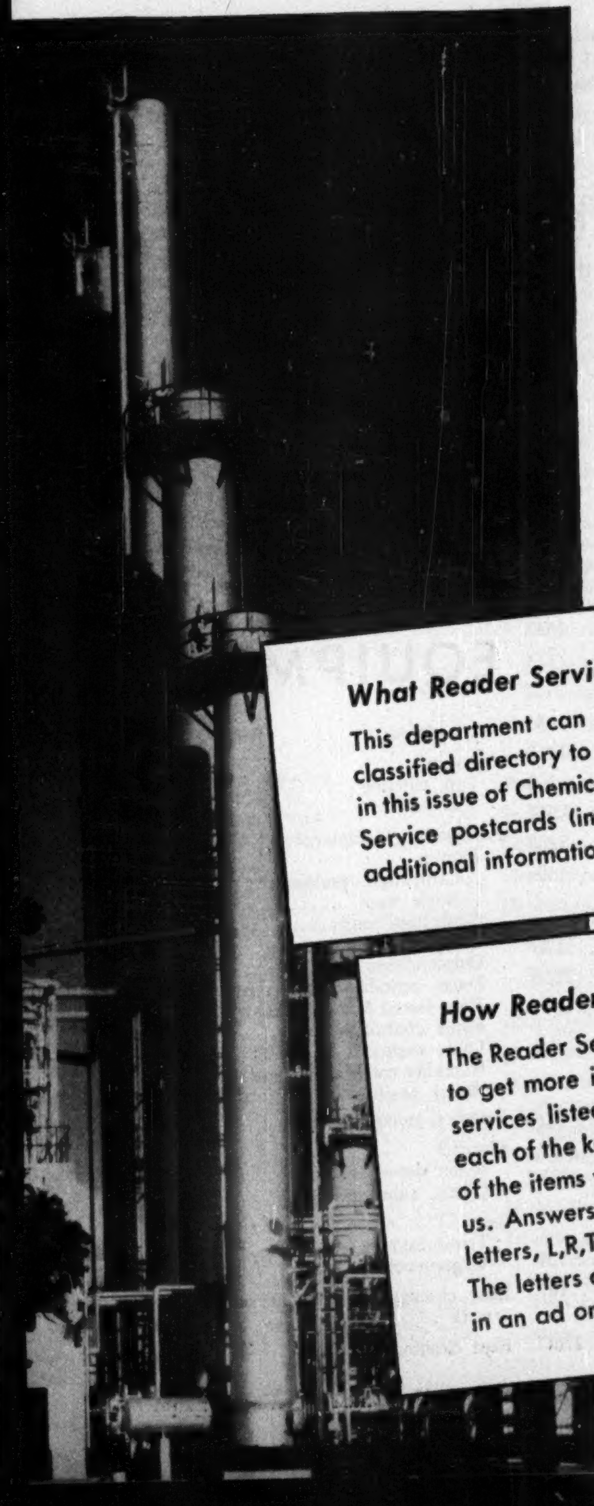

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• EQUIPMENT

• SERVICES

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This department can serve you in two ways. It is a complete classified directory to equipment, chemicals and services offered in this issue of Chemical Engineering. It is also a key to the Reader Service postcards (inside back cover) that will bring you free additional information on any of the listed items.

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The Reader Service postcards inside the back cover make it easy to get more information on any of the chemicals, equipment or services listed here. Each card has corresponding numbers for each of the key page numbers in this directory. Circle the numbers of the items you want; fill out the return address; mail the card to us. Answers will come direct to you from the companies. The letters, L,R,T,B, locate ads on the page: left, right, top, bottom. The letters a,b,c and A,B,C indicate first, second, third, etc., item in an ad or on a particular page.

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EQUIPMENT

SERVICES

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. . . Items in this Reader Service section as circled below:

3	24-25c	51	77	98b	131b	153a	206C	216A	224	232B	259	279	T298	316	320T	322U	340	360	R384
6	24-25d	52	79	98c	131c	153b	206D	216B	224A	233a	261	T280	B298	318	321	322V	341	361	385
7	26	53	80	98d	131d	153c	207A	218	224B	233b	262	B280	299	319	322	322W	343	362	386
8	27	54	81	99	132	153d	207B	218A	T225	234	264-265	281	300	320	322A	322X	L344	363	387
9	28-29	55	82	100	133	153e	207C	218B	B225	234A	267	282	T301	320A	322B	322Y	R344	364	388
10a	30	56-57	83	103	134	153f	207D	218C	225A	235	T268	283	B301	320B	322C	322Z	345	365	390
10b	31	58	84	104-105	136	153g	208A	219	226A	235A	B268	T284	303	320C	322D	323	346	366	391
10c	32	59	85	107	137	154	208B	219A	226B	236	T269	B284	304	320D	322E	324	347	367	L393
10d	33	60	86	109	139	155	208C	219B	227A	236A	B269	285	305	320E	322F	325a	348	368-369	R393
11	34	61	87	113	140	156	208D	220	227B	237a	T270	286	306a	320F	322G	325b	349	370	393
12	35	62	88-89a	115	141	157	209	220A	227C	237b	B270	287	306b	320G	322H	328	L350	371	394
13	36	63a	88-89b	117	142	158a	210A	220B	227D	237c	271	288	306c	320H	322I	329	TR350	372	395
14	37	63b	88-89c	118	143	158b	210B	221	227E	237d	T272	289	307	320I	322J	330a	BR350	373-374	396
15	38	64-65	88-89d	119	144	158c	210C	221A	228A	237e	B272	290	T308	320J	322K	330b	L351	375	L397
16a	39	66	88-89e	121	145	158d	211	221B	228B	242	T273	291	B308	320K	322L	331	R351	376-377	R397
16b	40-41	67	90	122	L146	159	212A	222A	228C	243	B273	292a	T309	320L	322M	333	L353	378	398
17	43	68	91	123	R146	160-161	212B	222B	228D	244	274	292b	B309	320M	322N	334	R353	L379	399
18	44	69	92-93	124	147	162	212C	222C	228E	247	275	292c	310	320N	322O	335	353	R379	L400
19	45a	70	94	125	148a	163	212D	222D	229	249	T276	292d	311	320O	322P	336	354	380	R400
20-21	45b	71	95a	126	148b	164-165	212E	222E	230	250	B276	293	312	320P	322Q	337	355	381	401
22	46	72-73	95b	129a	149a	166	213	223a	230A	251	T277	295	T313	320Q	322R	TL339	356	382	412
23	47	74	96	129b	149b	205	214A	223b	231	252-253	B277	296	B313	320R	322S	BL339	357	383	423
24-25a	48-49	75	97	130	150	206A	215	223c	232	255	T278	T297	314-315	320S	322T	R339	359	L384	424
24-25b	50	76	98a	131a	151	206B	216	223d	232A	257	B278	B297							

. . . Items in the Reader Service "Flashback" Section (p. 420)

208A	210F	214C	218B	222D	224D	230B	236A	238C	358E	358L	358S	359F	359M	359T	360F	360M	360T	362F	362M
209A	212A	214D	218C	222E	224E	231A	236B	238D	358F	358M	358T	359G	359N	359U	360G	360N	360U	362G	362N
209B	212B	214E	220A	222F	224F	231B	236C	238E	358G	358N	359A	359H	359O	360A	360H	360O	362A	362H	362O
210A	212C	214F	220B	222G	226A	231C	236D	358A	358H	358O	359B	359I	359P	360B	360I	360P	362B	362I	362P
210B	212D	214G	222A	224A	226B	232A	236E	358B	358I	358P	359C	359J	359Q	360C	360J	360Q	362C	362J	362Q
210C	212E	216A	222B	224B	228A	234A	238A	358C	358J	358Q	359D	359K	359R	360D	360K	360R	362D	362K	362R
210D	214A	216B	222C	224C	230A	234B	238B	358D	358K	358R	359E	359L	359S	360E	360L	360S	362E	362L	362S
210E	214B	218A																	

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6	24-25d	52	79	98c	131c	153b	206D	216B	224A	232a	261	T280	B298	318	321	322V	341	361	385
7	26	53	80	98d	131d	153c	207A	218	224B	232b	262	B280	299	319	322	322W	343	362	386
8	27	54	81	99	132	153d	207B	218A	T225	234	264-265	281	300	320	322A	322X	L344	363	387
9	28-29	55	82	100	133	153e	207C	218B	B225	234A	267	282	T301	320A	322B	322Y	R344	364	388
10a	30	56-57	83	103	134	153f	207D	218C	225A	235	T268	283	B301	320B	322C	322Z	345	365	390
10b	31	58	84	104-105	136	153g	208A	219	226A	235A	B268	T284	302	320C	322D	323	346	366	391
10c	32	59	85	107	137	154	208B	219A	226B	236	T269	B284	304	320D	322E	324	347	367	L392
10d	33	60	86	109	139	155	208C	219B	227A	236A	B269	285	305	320E	322F	325a	348	368-369	R392
11	34	61	87	113	140	156	208D	220	227B	237a	T270	286	306a	320F	322G	325b	349	370	393
12	35	62	88-89a	115	141	157	209	220A	227C	237b	B270	287	306b	320G	322H	326	L350	371	394
13	36	63a	88-89b	117	142	158a	210A	220B	227D	237c	271	288	306c	320H	322I	329	TR350	372	395
14	37	63b	88-89c	118	143	158b	210B	221	227E	237d	T272	289	307	320I	322J	330a	BR350	373-374	396
15	38	64-65	88-89	119	144	158c	210C	221A	228A	237e	B272	290	T308	320J	322K	330b	L351	375	L397
16a	39	66	88-89e	121	145	158d	211	221B	228B	242	T273	291	B308	320K	322L	331	R351	376-377	R397
16b	40-41	67	90	122	L146	159	212A	222A	228C	243	B273	292a	T309	320L	322M	333	L352	378	398
17	42	68	91	123	R146	160-161	212B	222B	228D	244	274	292b	B309	320M	322N	334	R352	L379	399
18	44	69	92-93	124	147	162	212C	222C	228E	247	275	292c	310	320N	322O	335	353	R379	L400
19	45a	70	94	125	148a	163	212D	222D	229	249	T276	292d	311	320O	322P	336	354	380	R400
20-21	45b	71	95a	126	148b	164-165	212E	222E	230	250	B276	293	312	320P	322Q	337	355	381	401
22	46	72-73	95b	129a	149a	166	213	223a	230A	251	T277	295	T313	320Q	322R	TL339	356	382	412
23	47	74	96	129b	149b	205	214A	223b	231	252-253	B277	296	B313	320R	322S	BL339	357	383	423
24-25a	48-49	75	97	130	150	206A	215	223c	232	255	T278	T297	314-315	[illegible]	322T	R339	359	L384	424
24-25b	50	76	98a	131a	151	206B	216	223d	232A	257	B278	B297							

. . . Items in the Reader Service "Flashback" Section (p. 420)

208A	210F	214C	218B	222D	224D	230B	236A	238C	358E	358L	358S	359F	359M	359T	360F	360M	360T	362F	362M
209A	212A	214D	218C	222E	224E	231A	236B	238D	358F	358M	358T	359G	359N	359U	360G	360N	360U	362G	362N
209B	212B	214E	220A	222F	224F	231B	236C	238E	358G	358N	359A	359H	359O	360A	360H	360O	362A	362H	362O
210A	212C	214F	220B	222G	226A	231C	236D	358A	358H	358O	359B	359I	359P	360B	360I	360P	362B	362I	362P
210B	212D	214G	222A	224A	226B	232A	236E	358B	358I	358P	359C	359J	359Q	360C	360J	360Q	362C	362J	362Q
210C	212E	216A	222B	224B	228A	234A	238A	358C	358J	358Q	359D	359K	359R	360D	360K	360R	362D	362K	362R
210D	214A	216B	222C	224C	230A	234B	238B	358D	358K	358R	359E	359L	359S	360E	360L	360S	362E	362L	362S
210E	214B	218A																	

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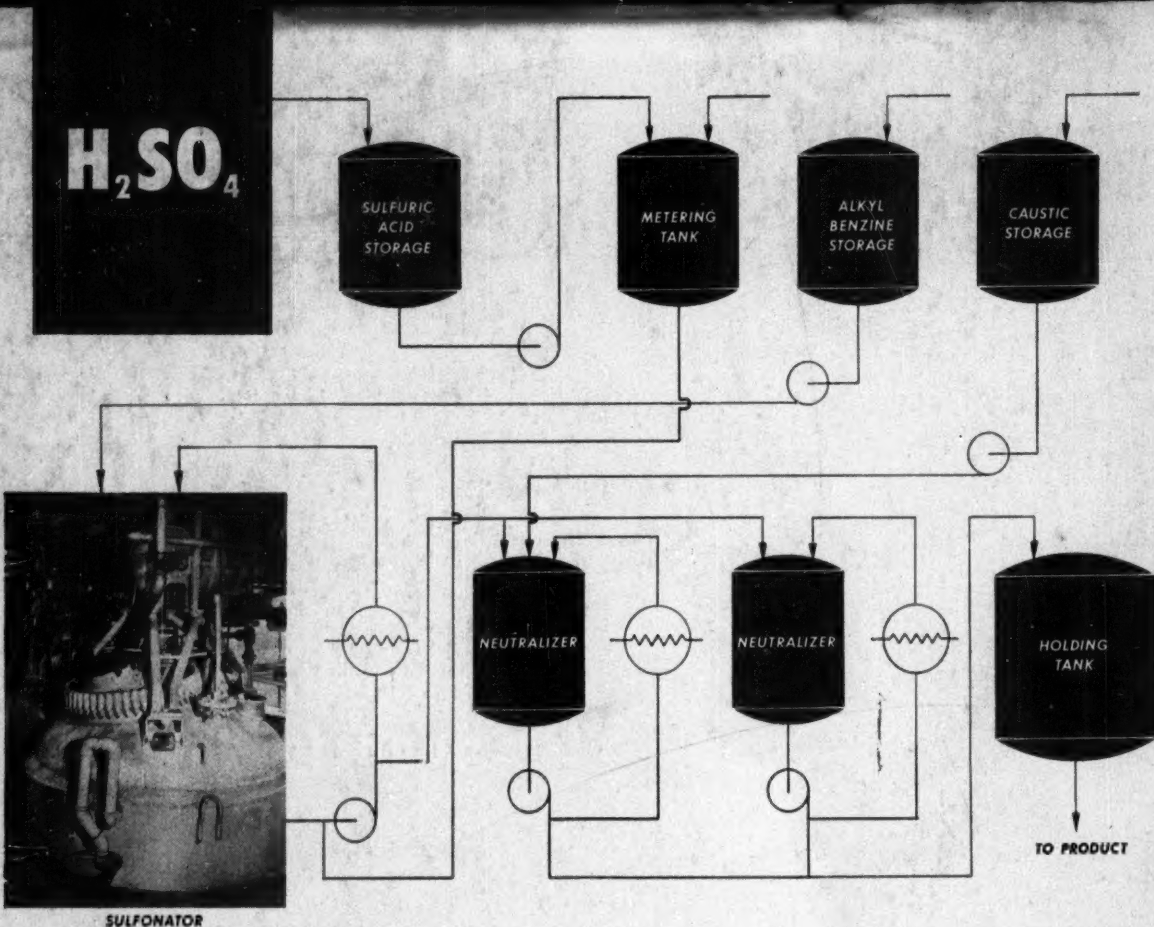
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